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ELECTRICAL TIMES

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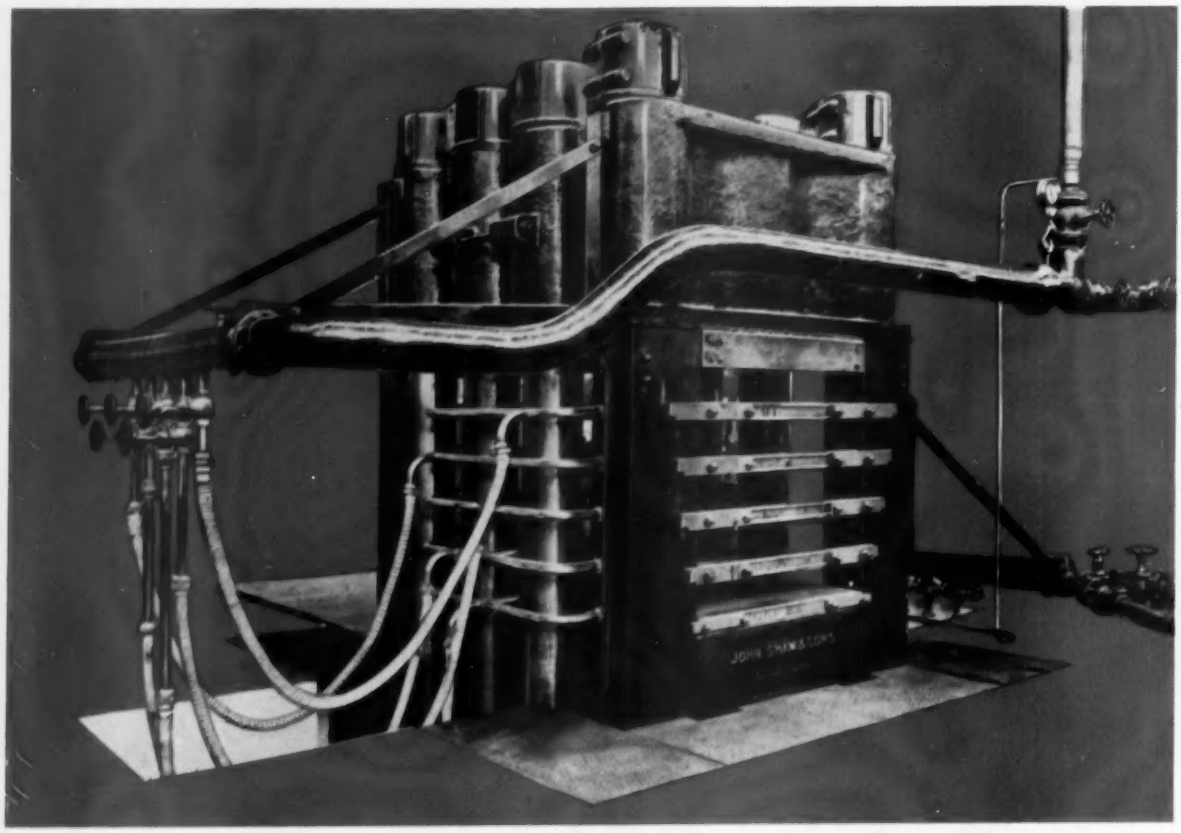

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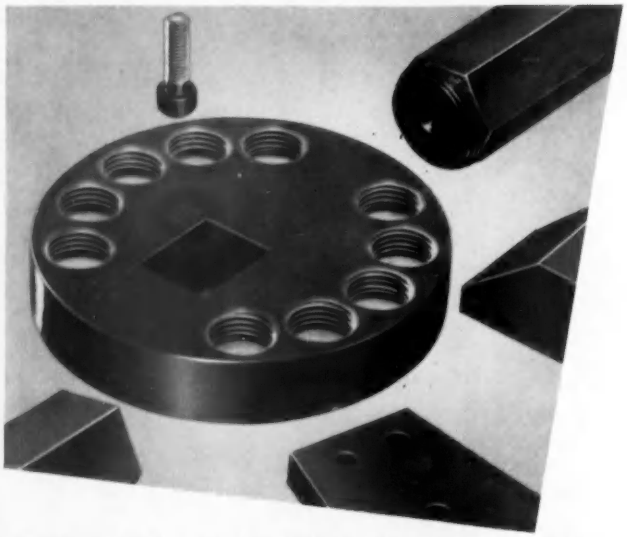

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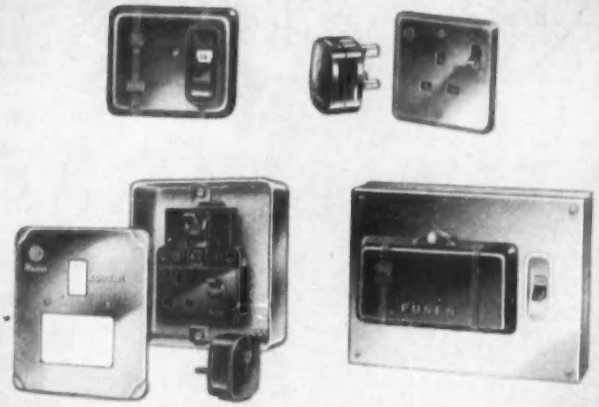

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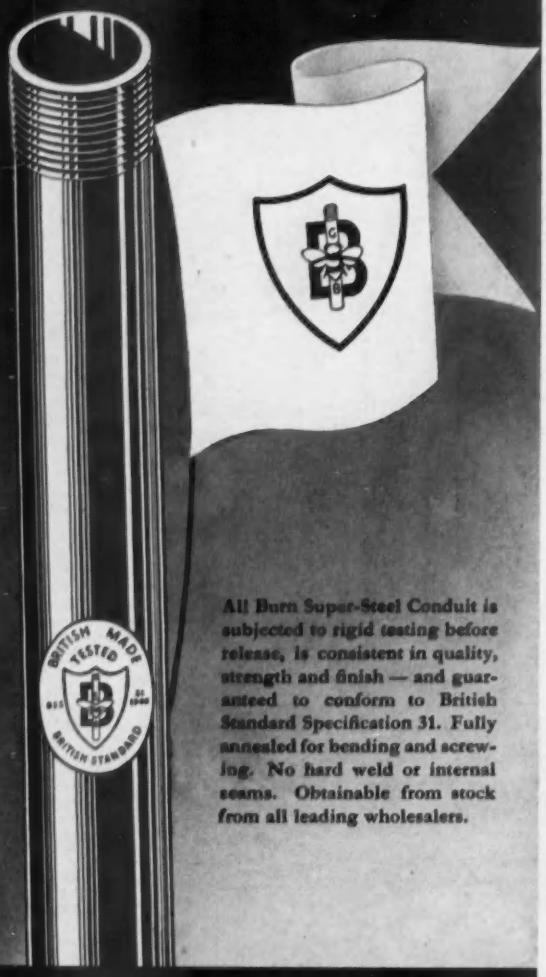

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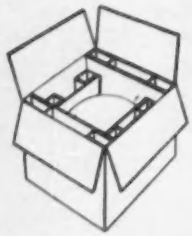

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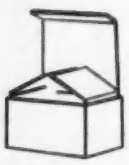

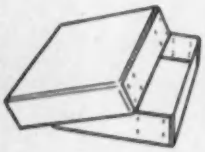

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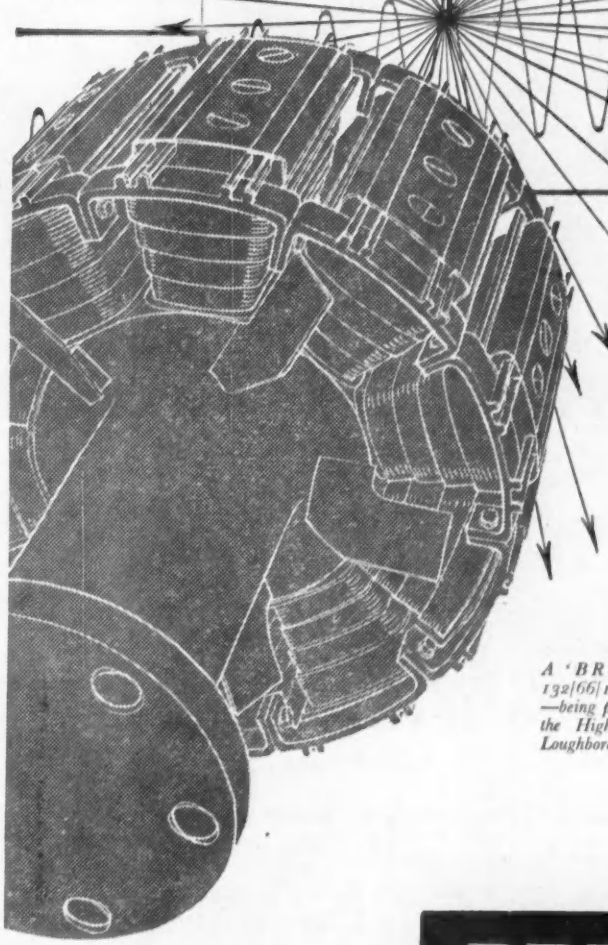

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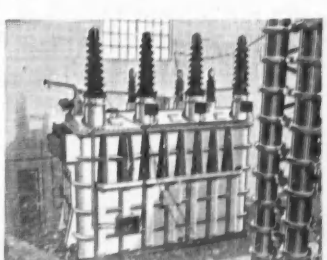

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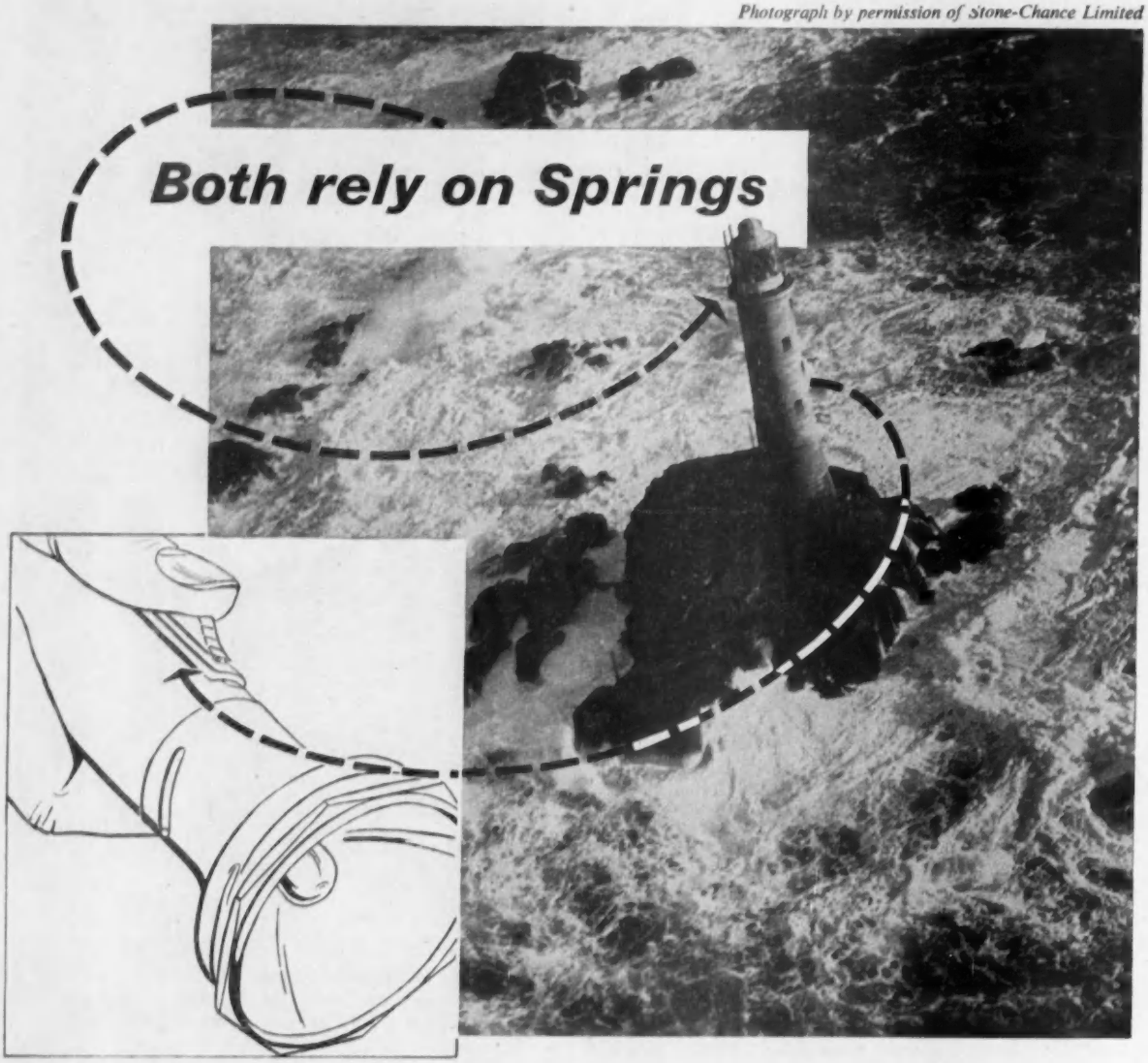

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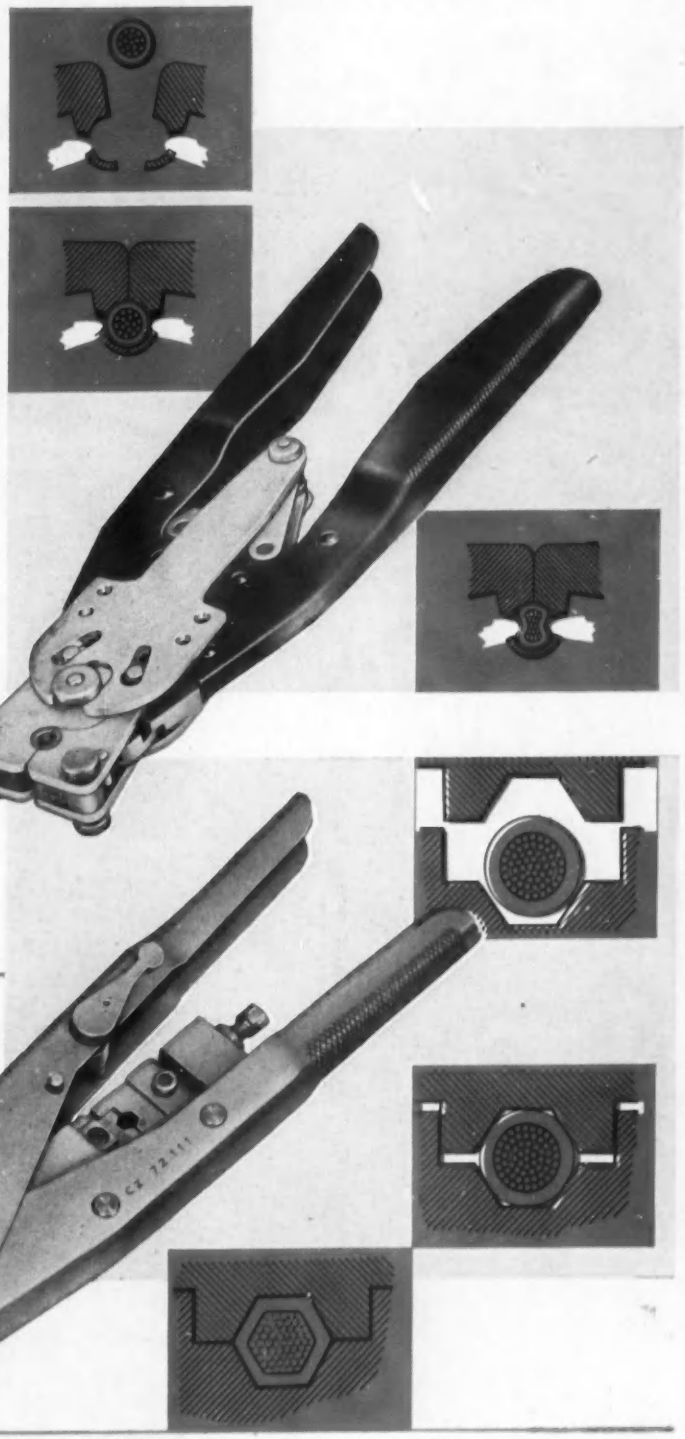

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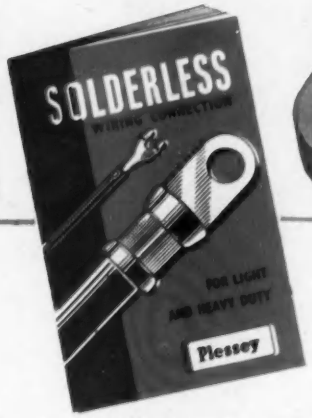

Plessey publication 753/1 contains extensive details of these tools and their application. A copy will be sent to Manufacturing and Government Department executives and to design engineers free, on request.

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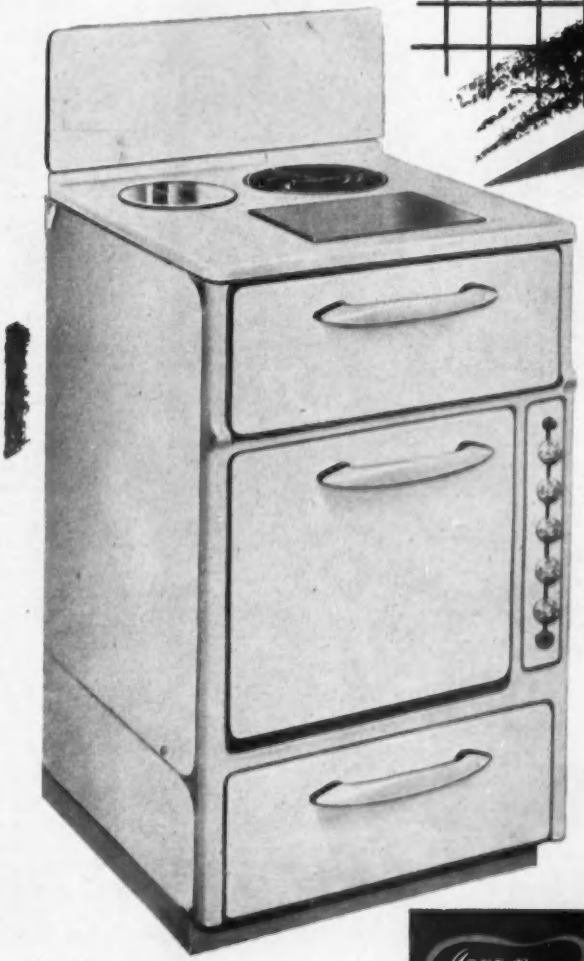

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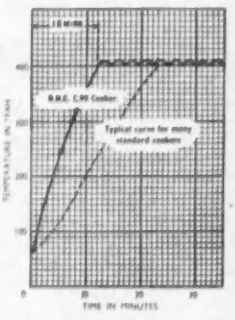

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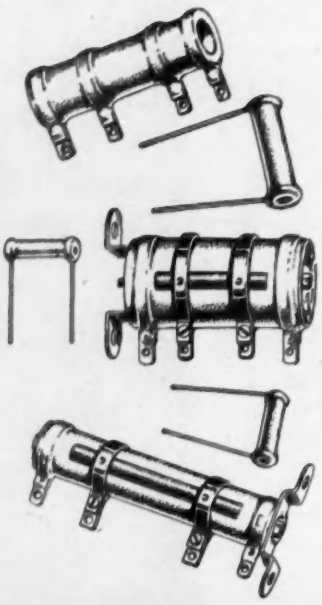

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(*Left*) A night view of Haddington, Scotland, illuminated by Revo Vertical Wall Mounted Fittings (catalogue No. C14446) each using 3-5 ft. 80 watt fluorescent lamps.

(*Below*) A close-up of the same lantern by day showing the neat appearance when mounted in position.

(*Photographs by permission of the South of Scotland Electricity Board and Haddington Town Council.*)

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A view of the Ferranti Transformer Factory at Hollinwood.

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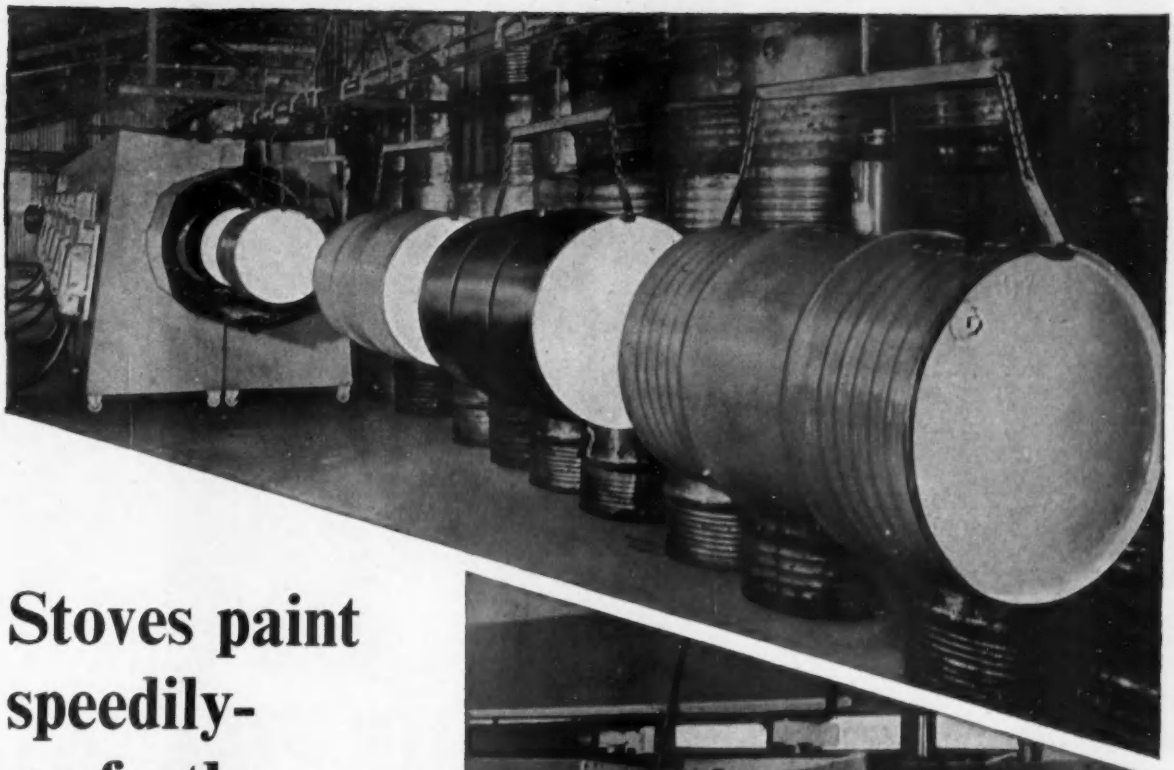

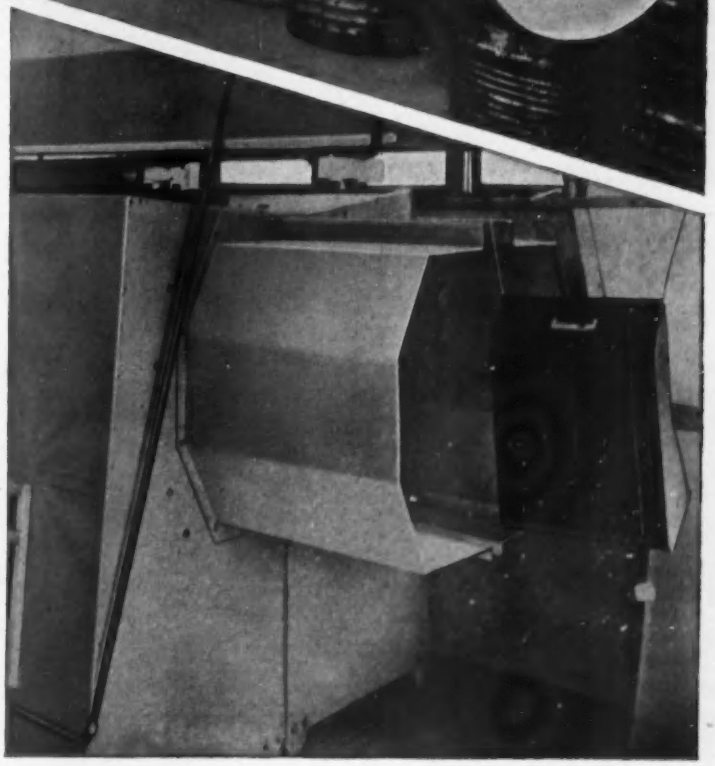

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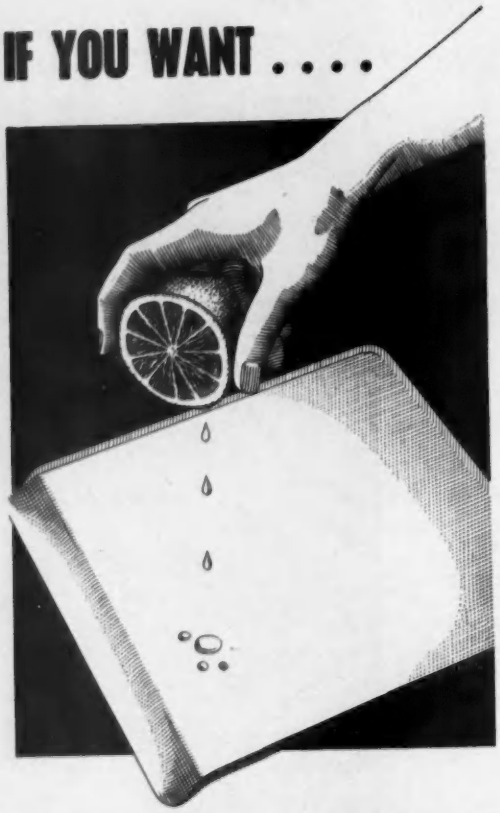

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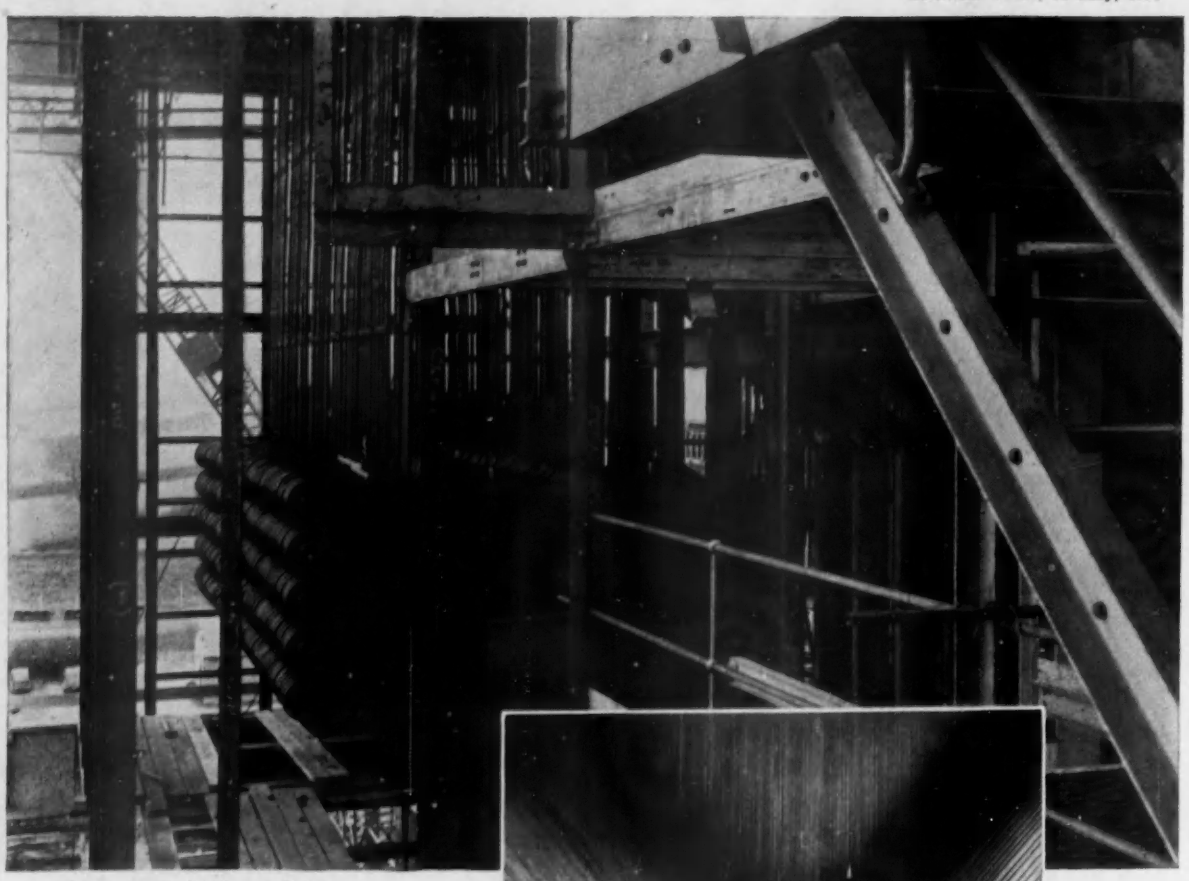

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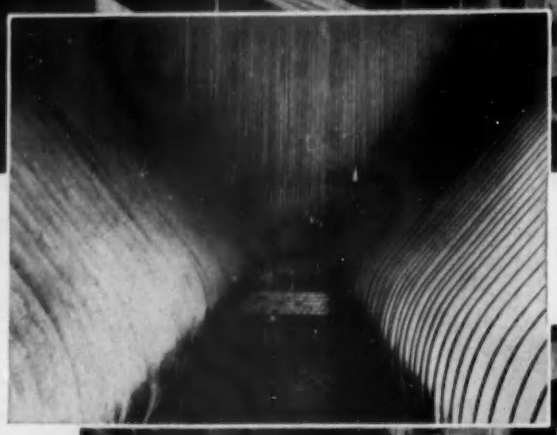

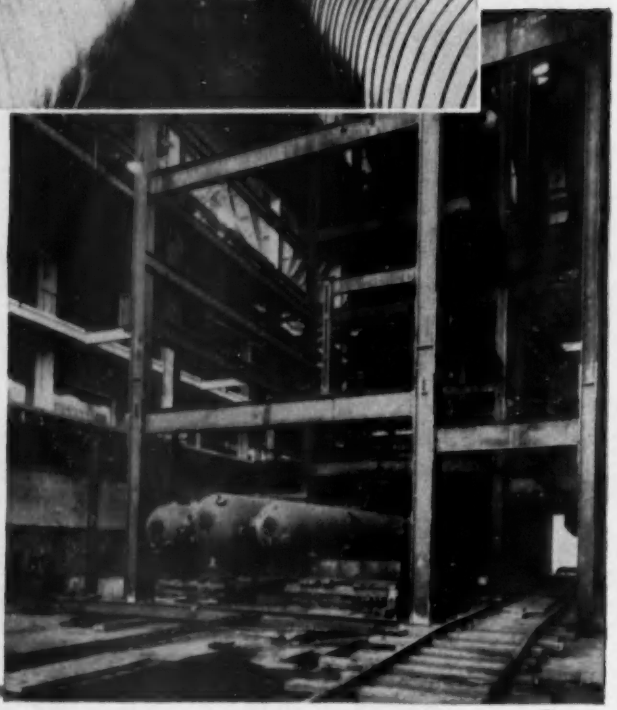

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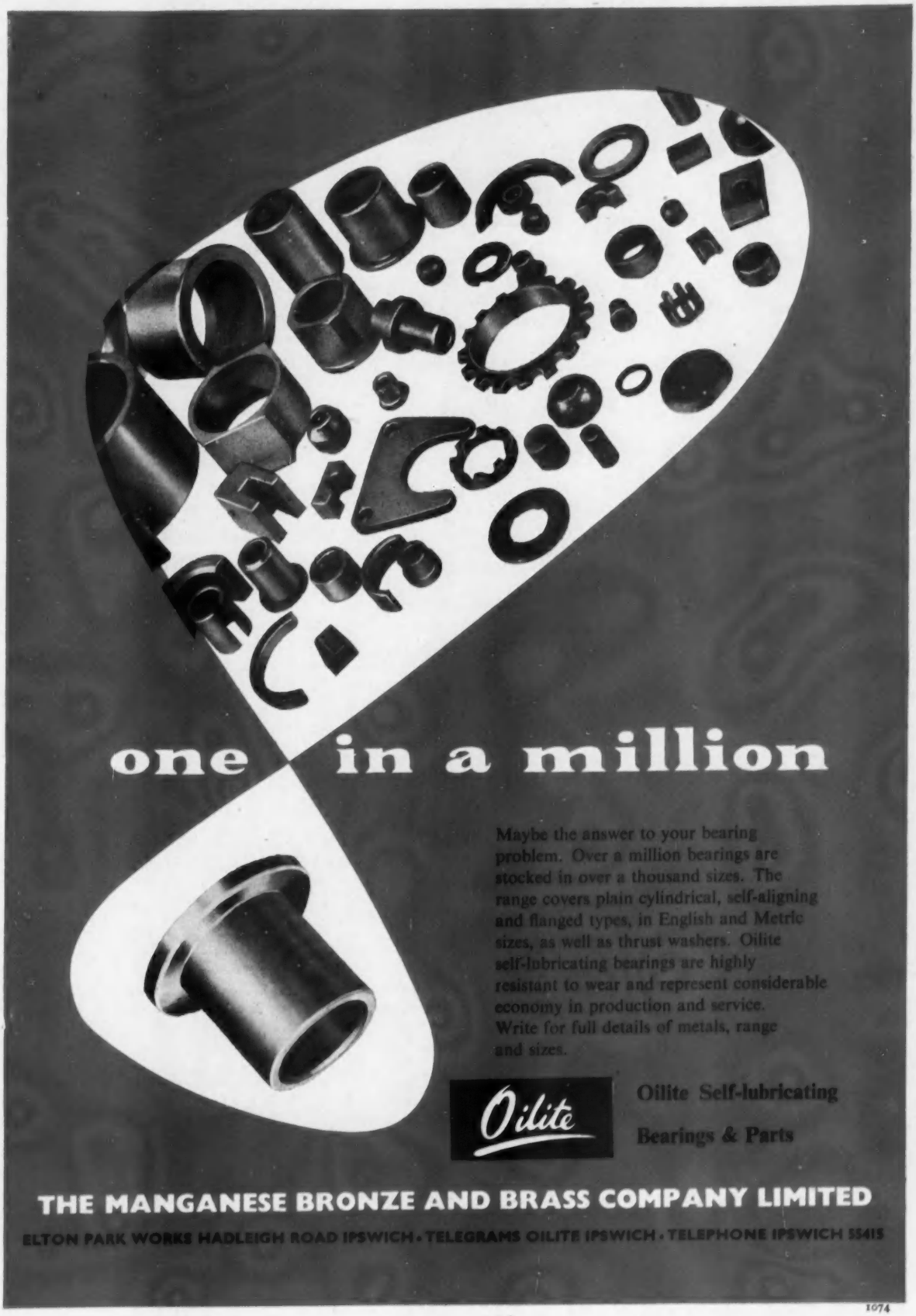
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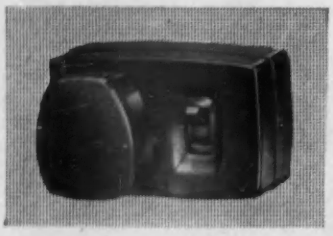

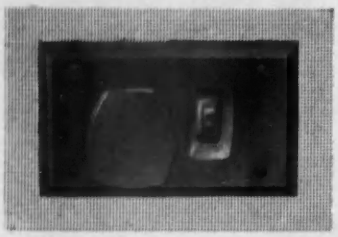

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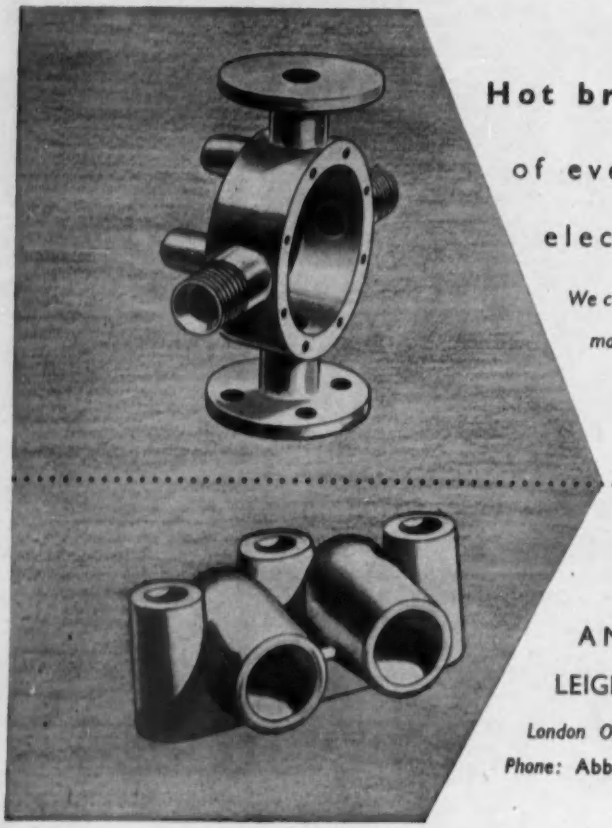

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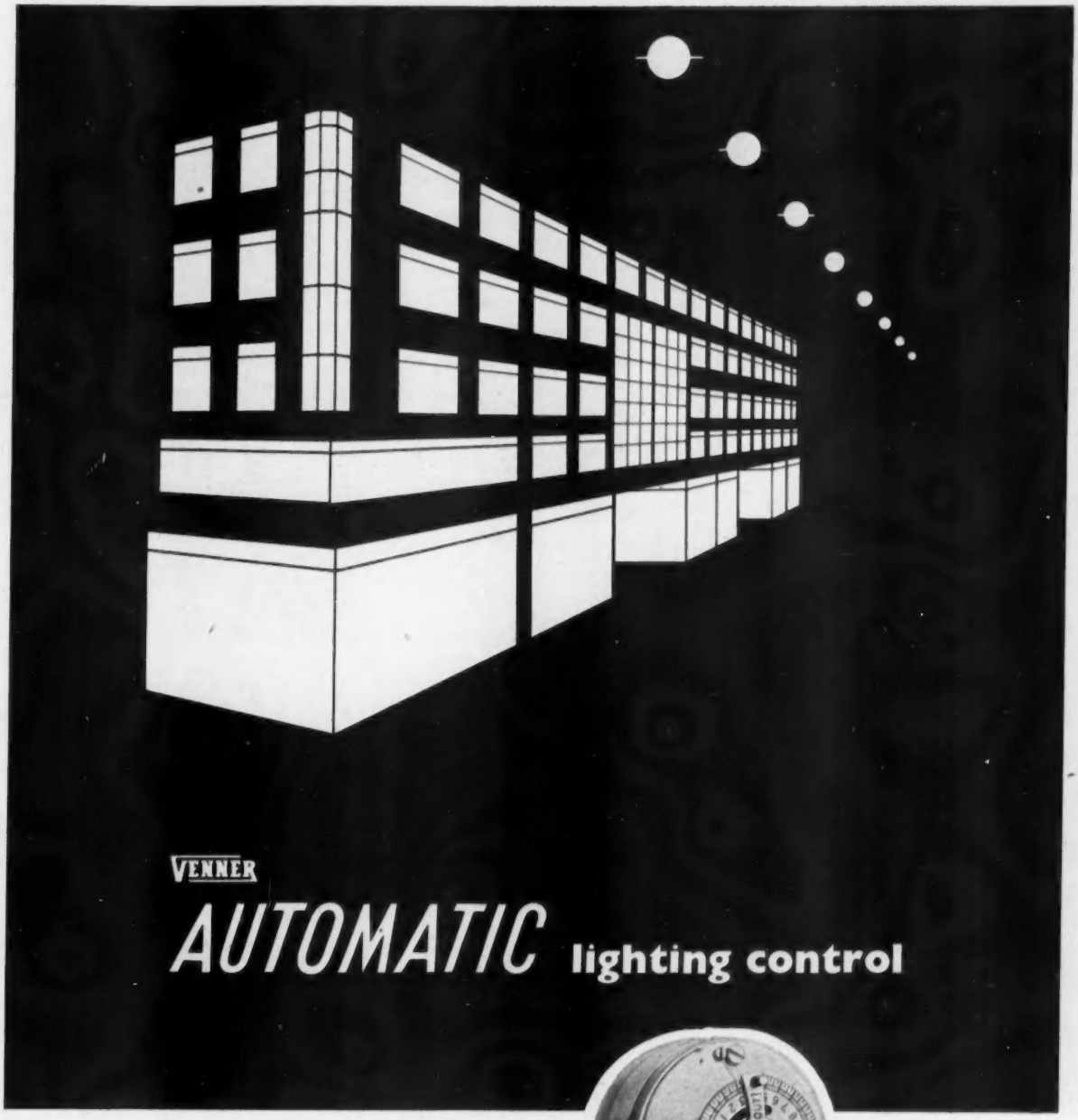

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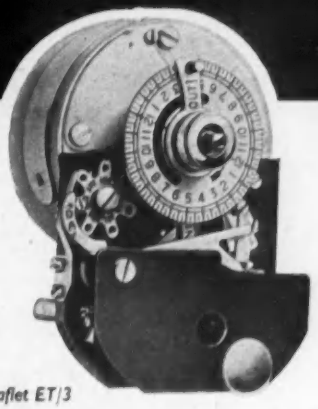

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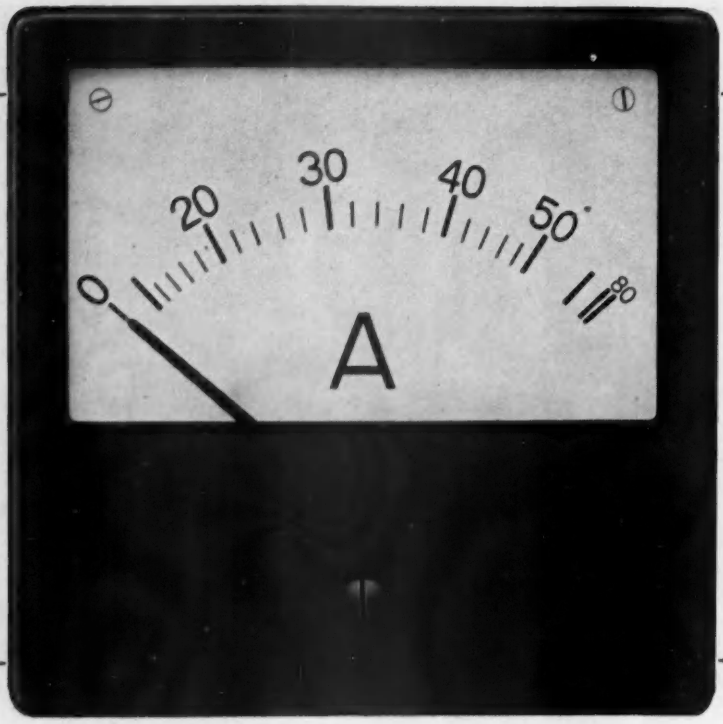

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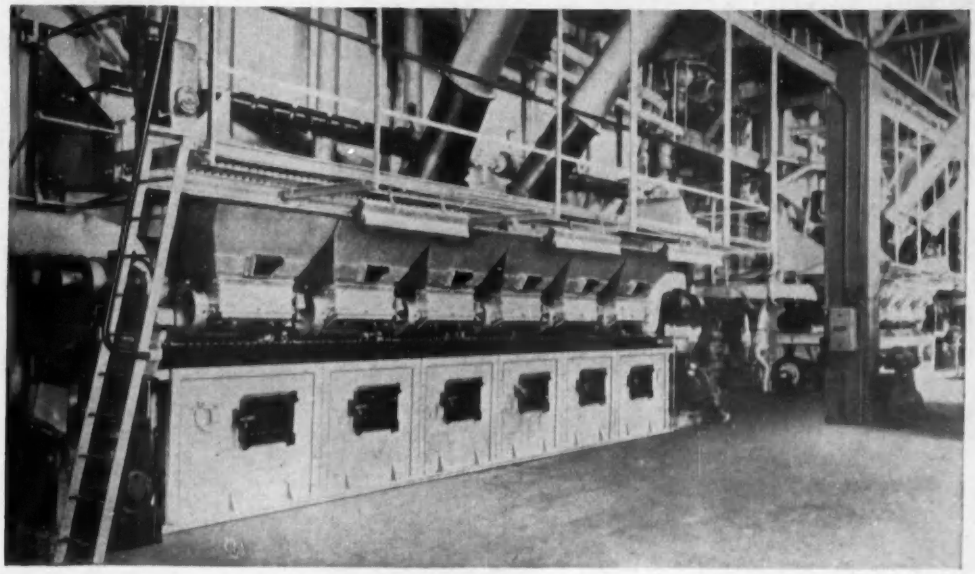


Babcock-Detroit spreader stokers firing Babcock Bi-drum boilers, each for 150,000 lb./hr. at 625 lb./sq. in., 865° F, at Osborne B power station, Adelaide (The Electricity Trust of South Australia).

The

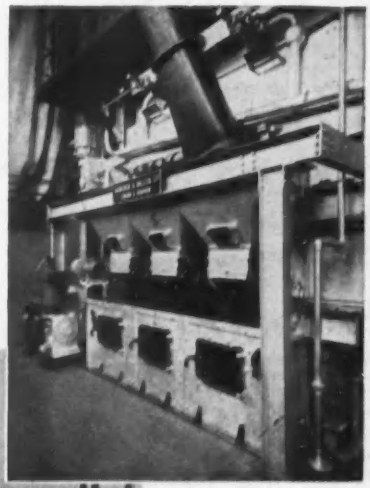
BABCOCK-DETROIT *Spreader* STOKER

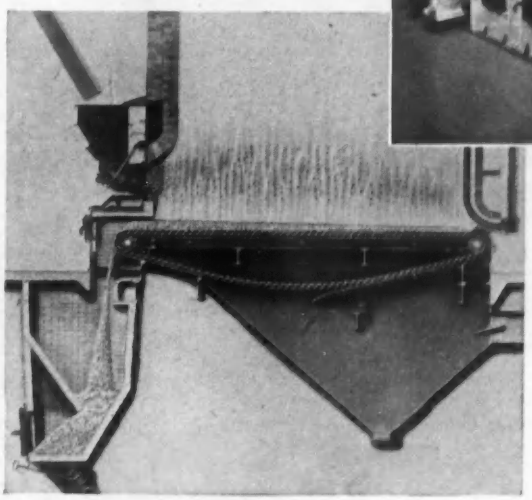
the most *versatile* and *flexible* form of stoker firing for water-tube boilers.

Versatile, because it burns efficiently an exceptionally wide range of low-grade and "difficult" fuels—e.g. fuels with low ash-fusion temperatures, or a high proportion of fines, and including waste-product fuels fired separately or in combination with coal.

Flexible in operation, because it tolerates wide changes in fuel quality without loss of efficiency and is *rapidly responsive to load changes*. Can be banked and brought up to full load with very low fuel consumption.

Flexible in application, as it is available in three types; with *fixed, dumping* or *forward-travelling grate*, to meet most effectively the stoker requirements of every installation from small industrial boilers to power station units, of capacities up to approximately 250,000 lb. steam/hr.





One of 2 Babcock-Detroit stokers firing Cross-type boilers, in the North boiler house of Guest, Keen & Nettlefolds (Midlands) Ltd.

FUEL is delivered to simply adjusted feeder units disposed across the furnace width. Each is equipped with an "overthrow" rotor, the curved blades of which project the fuel into the combustion chamber, where it is burned partly in suspension and partly on the grate, at an even rate of combustion over the whole grate area.

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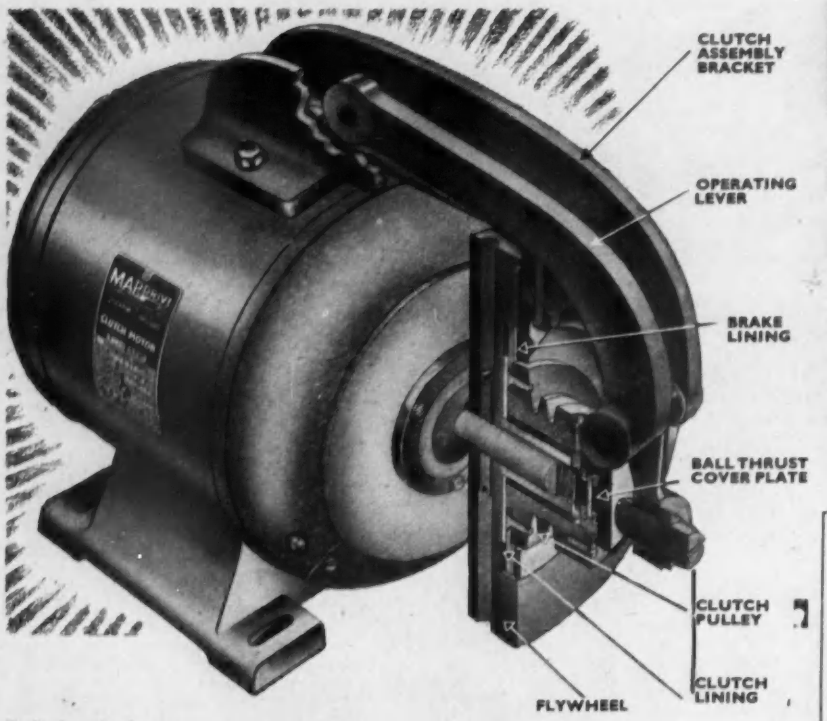

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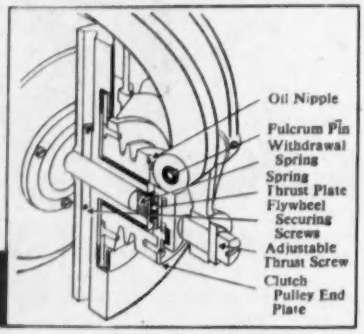

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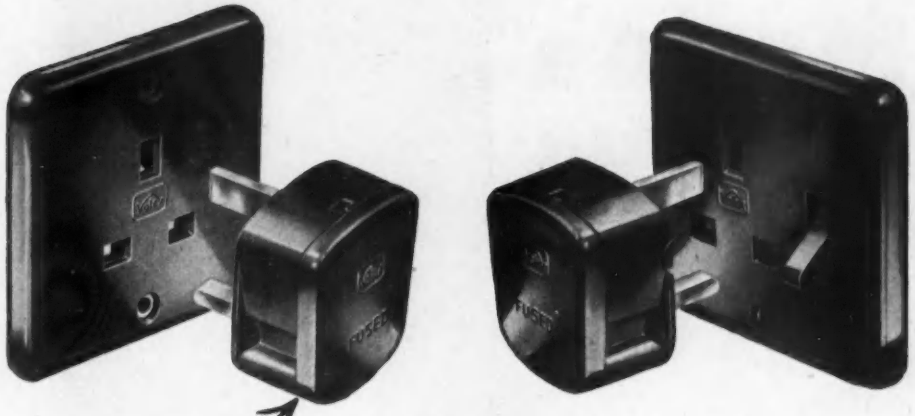

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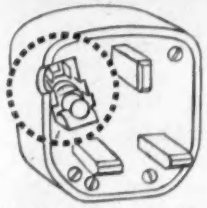

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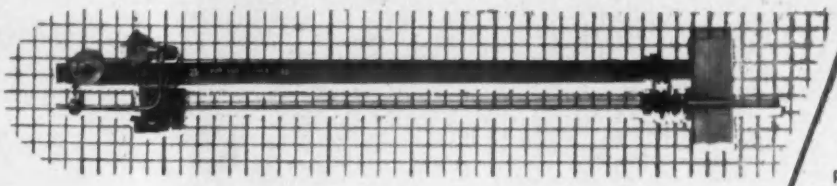

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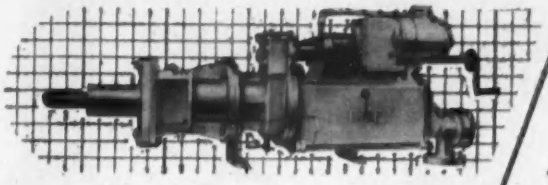
The unsupported nozzle advances up to twenty feet with oscillatory motion to give maximum cleaning with minimum steam consumption. (Electrically Operated.)



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For combustion chamber walls and mass-jet cleaning of convection surfaces. A standard 12" withdrawal with robust construction gives improved access and simplified maintenance.

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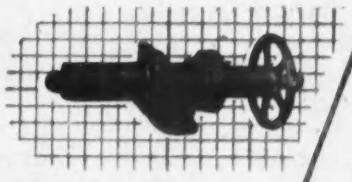

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This head can also be used with rotating multi-nozzle elements. (Manually Operated.)

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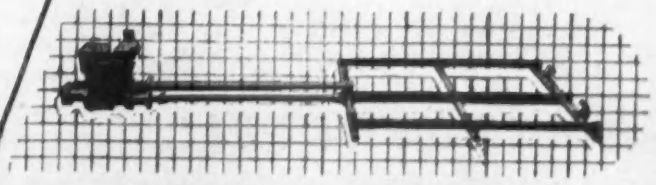

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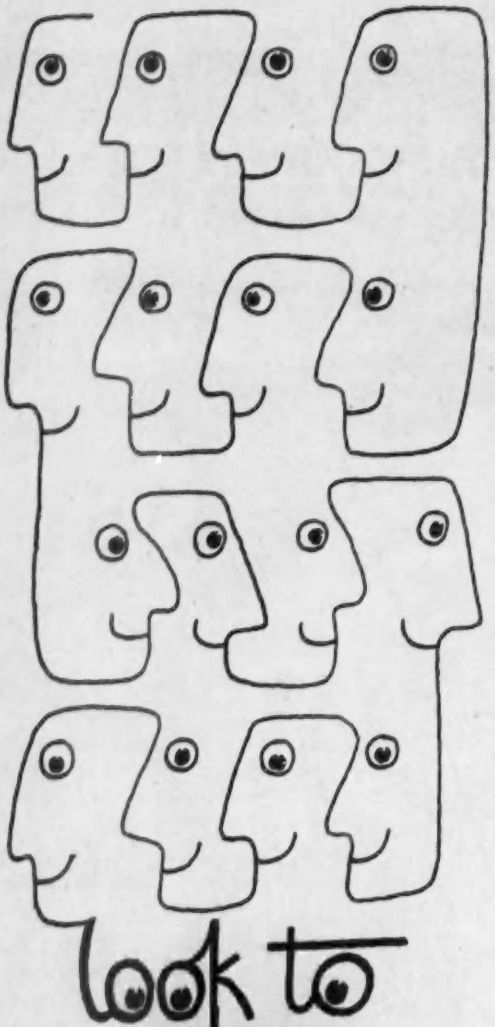

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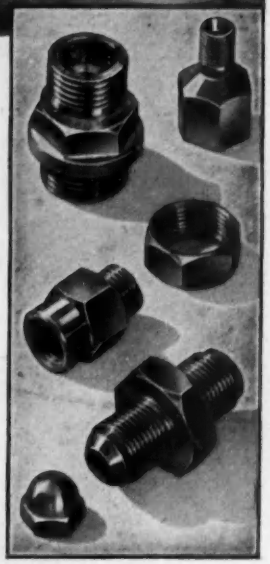

Ever higher speeds demand ever greater precision—and British industry needs both if production is to be increased and costs reduced. McKechnie Brothers have developed a range of standard high-speed turning and screwing rods, including the popular **No. 4** and **YS**, all of which are guaranteed to combine the correct alloy and temper for maximum machine speeds and longest tool life. For full details of these and other MKB free machining rods please write to—

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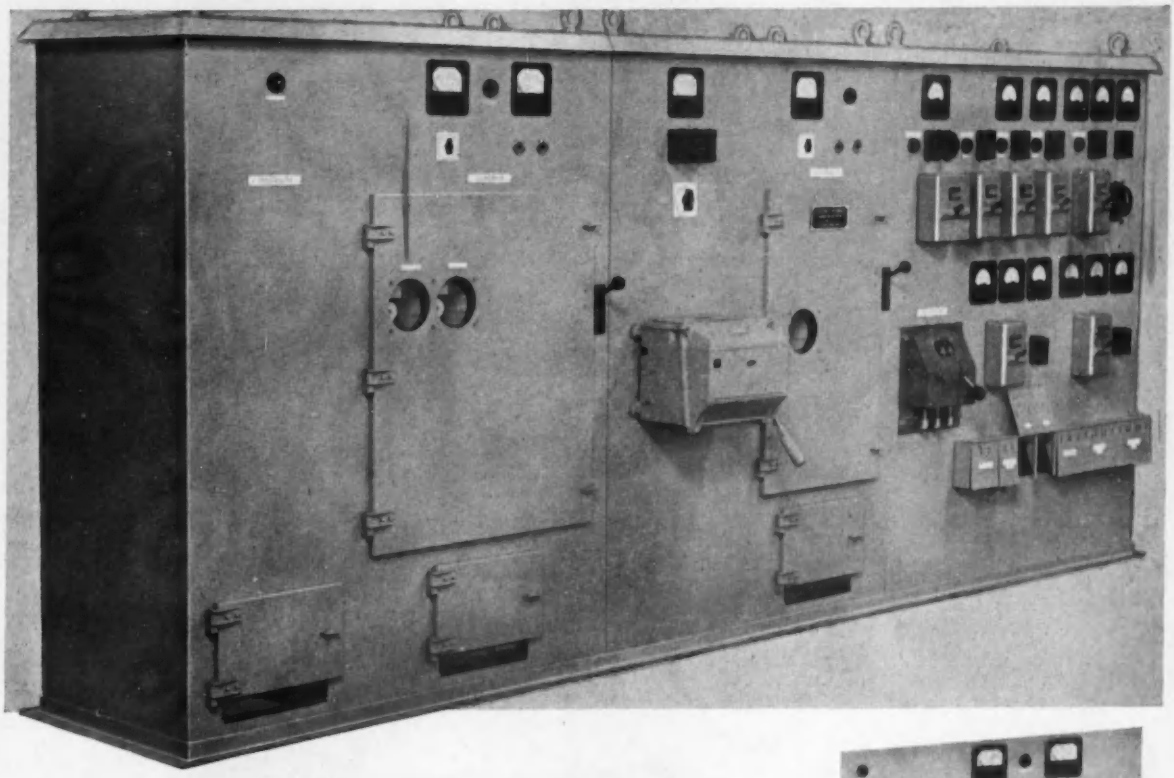

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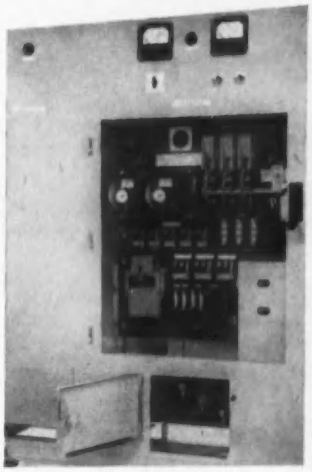

ABOVE: Part view of 20/60 H.P. section of panel, showing isolator; stator-contactor overload relay with range selector switch; earth leakage relays for HT and LT circuits and selector links. Terminals for Test leads under separate interlocked cover below.

COMPLETE Panel includes section for 3,300 volts 3-phase motors up to 100 H.P.; for motors of 20/60 H.P. 440 volts 3-phase; for motors up to 20 H.P. 440 volts; and one multi-circuit panel for various low power supplies.

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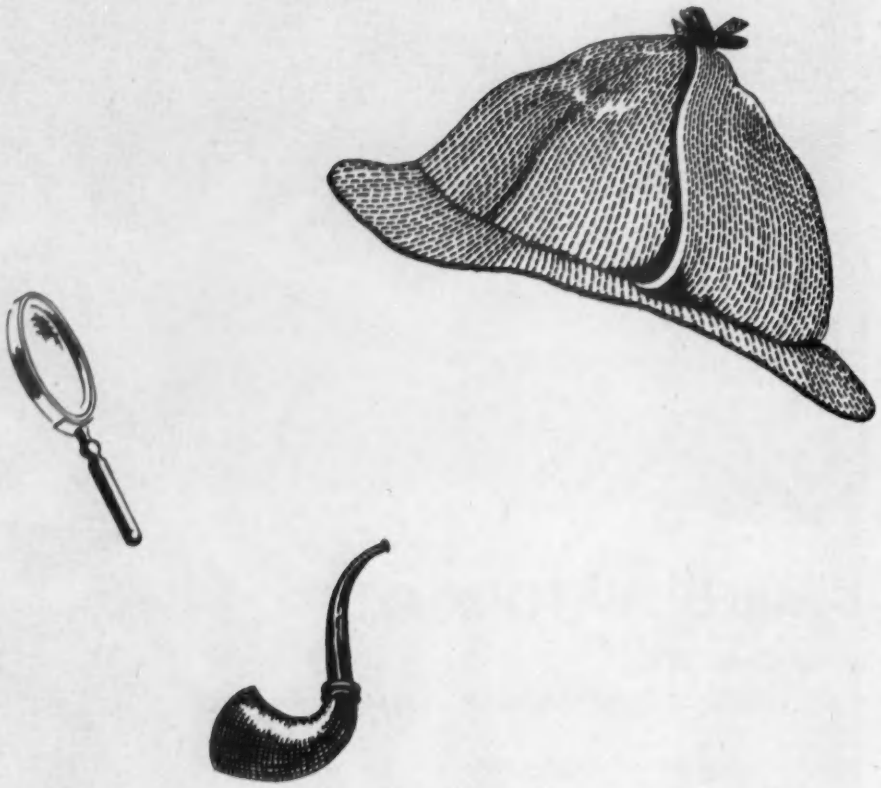

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Today the design and technical precision of the Evershed range of "Megger" Insulation Testers is as renowned as was Holmes in another field of detection.

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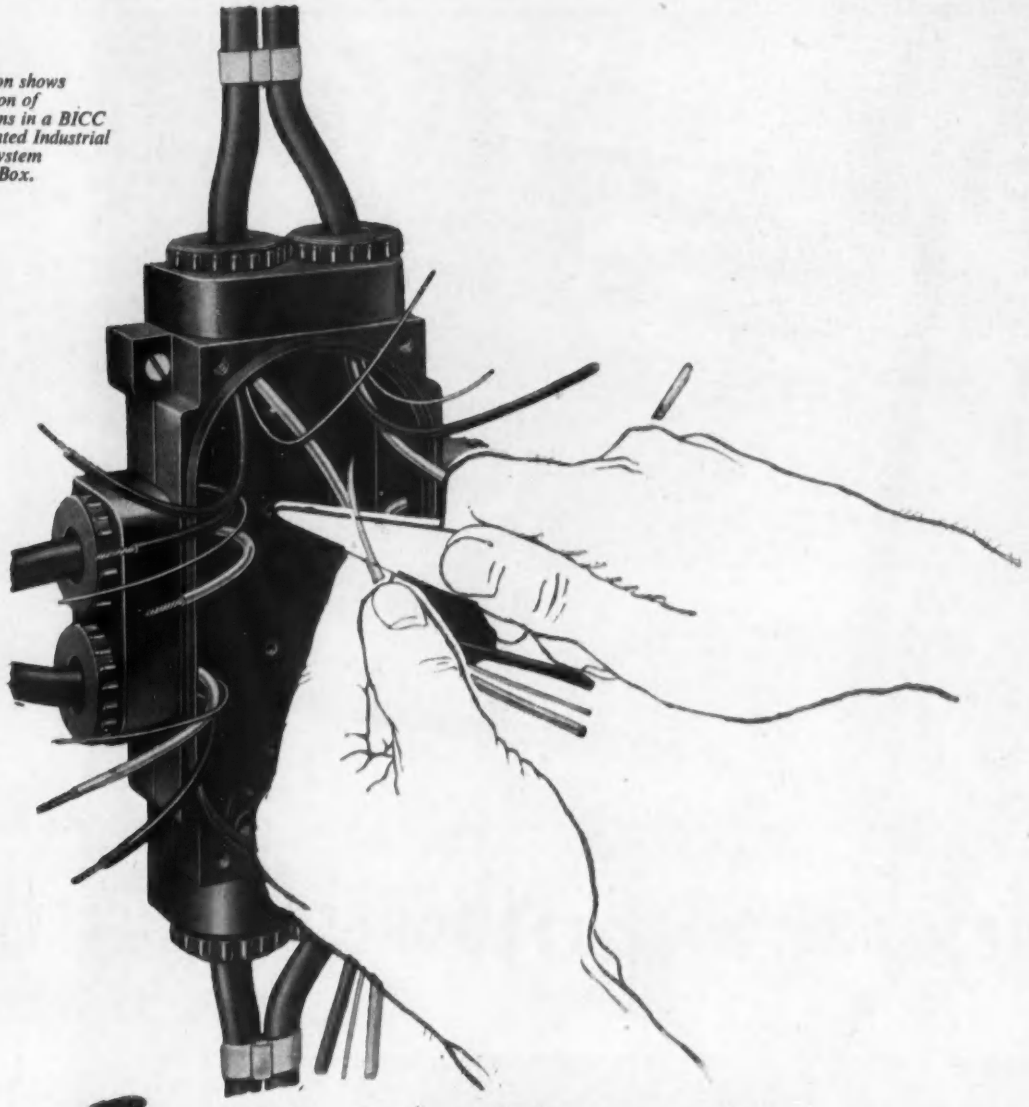
Illustration shows preparation of connections in a BICC All-Insulated Industrial Wiring System Junction Box.



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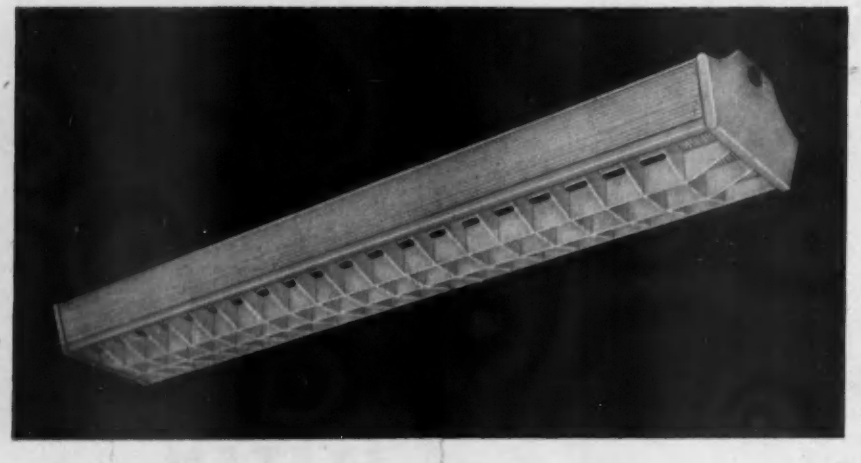
THE *Eterna* LOUVRED FLUORESCENT FITTING
...introduced



for special use in stores, offices and showrooms is also suitable for industrial applications where appearance is equally important.

● In addition to the standard finish of hard gloss white, ETERNA Louvred Fittings are available in various colours and in the following sizes:—

4 ft. for TWIN 40 Watt Lamps
5 ft. „ „ 80 „ „
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5 ft. „ FOUR 80 „ „

● All ETERNA Louvred Fittings incorporate our well known Grade "A" H.P.F. Control Gear completely enclosed in chassis for dust exclusion. Side panels are of luminous glass removable for easy cleaning and lamp replacement. Provision is made for chain or conduit suspension.

● Other ETERNA models available. Also full range of Fluorescent Control Gear and Accessories.

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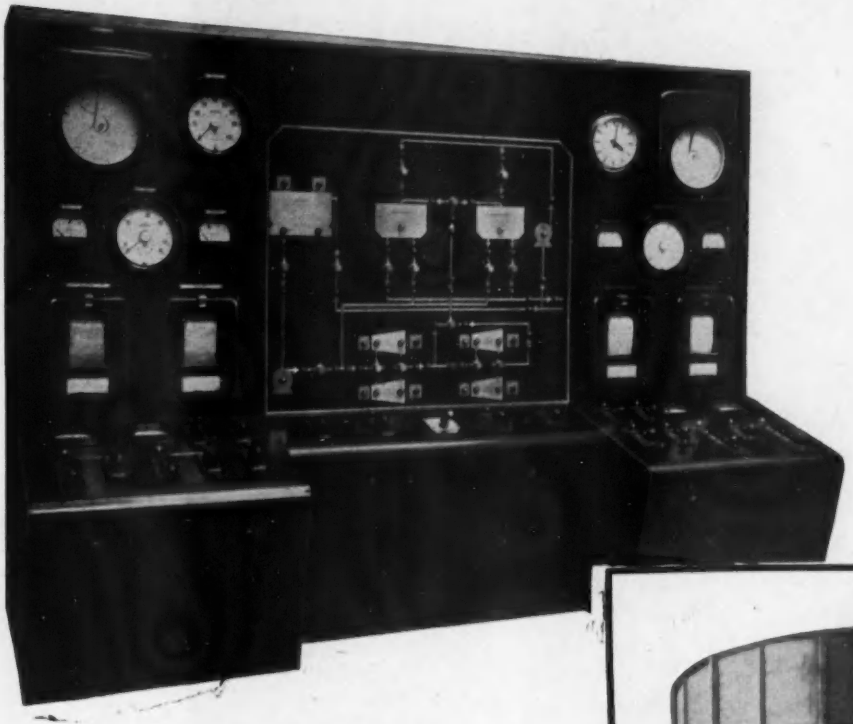

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For over half a century Igranic engineers have worked with the technicians of many industries to meet their specialised needs in motor control—to devise new control methods and equipment to do things faster, better and at a lower cost; and throughout the world Igranic motor control gear is faithfully serving important installations in this way.

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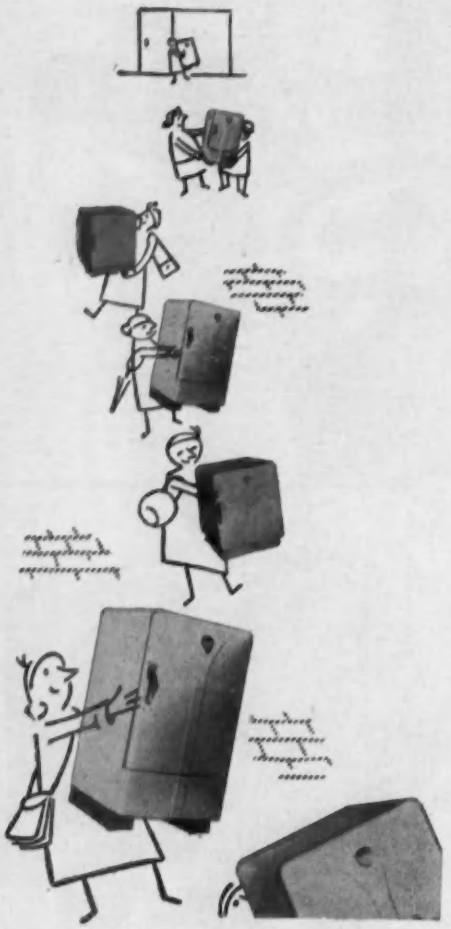

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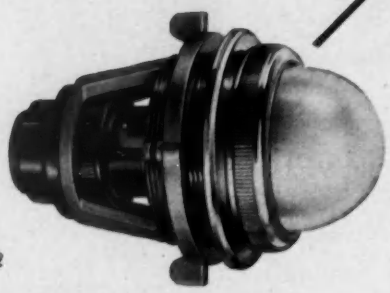

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No. 7670. Now fitted as standard with easy back-wiring porcelain lampholder or can still be fitted with all insulated lampholder as shown above.

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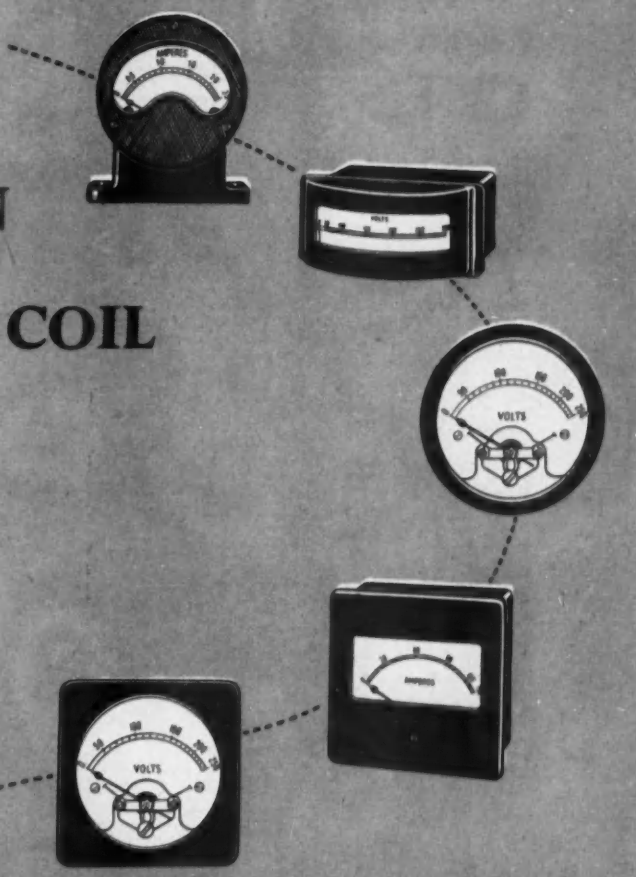

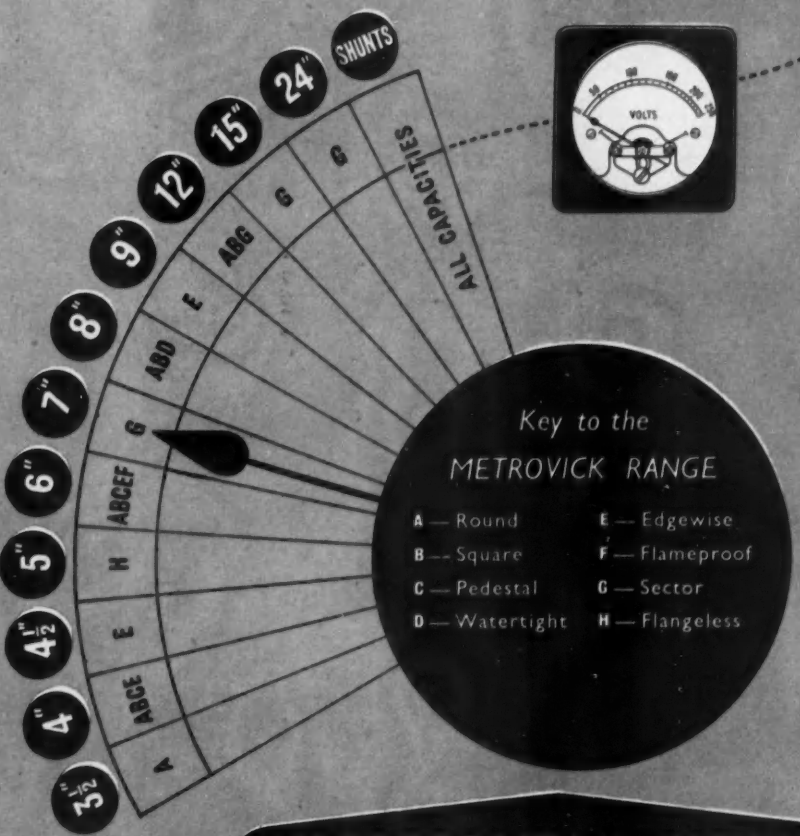

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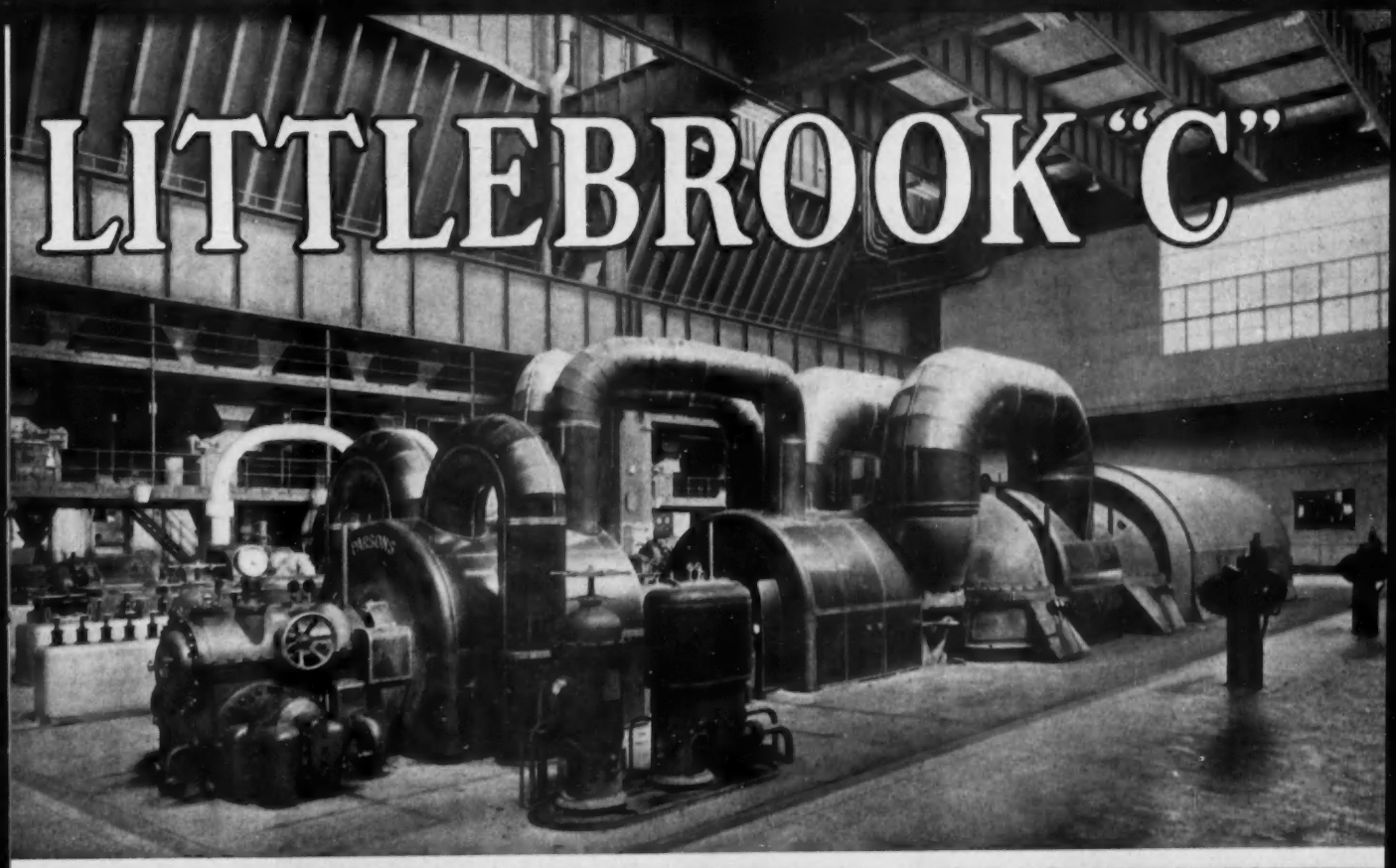

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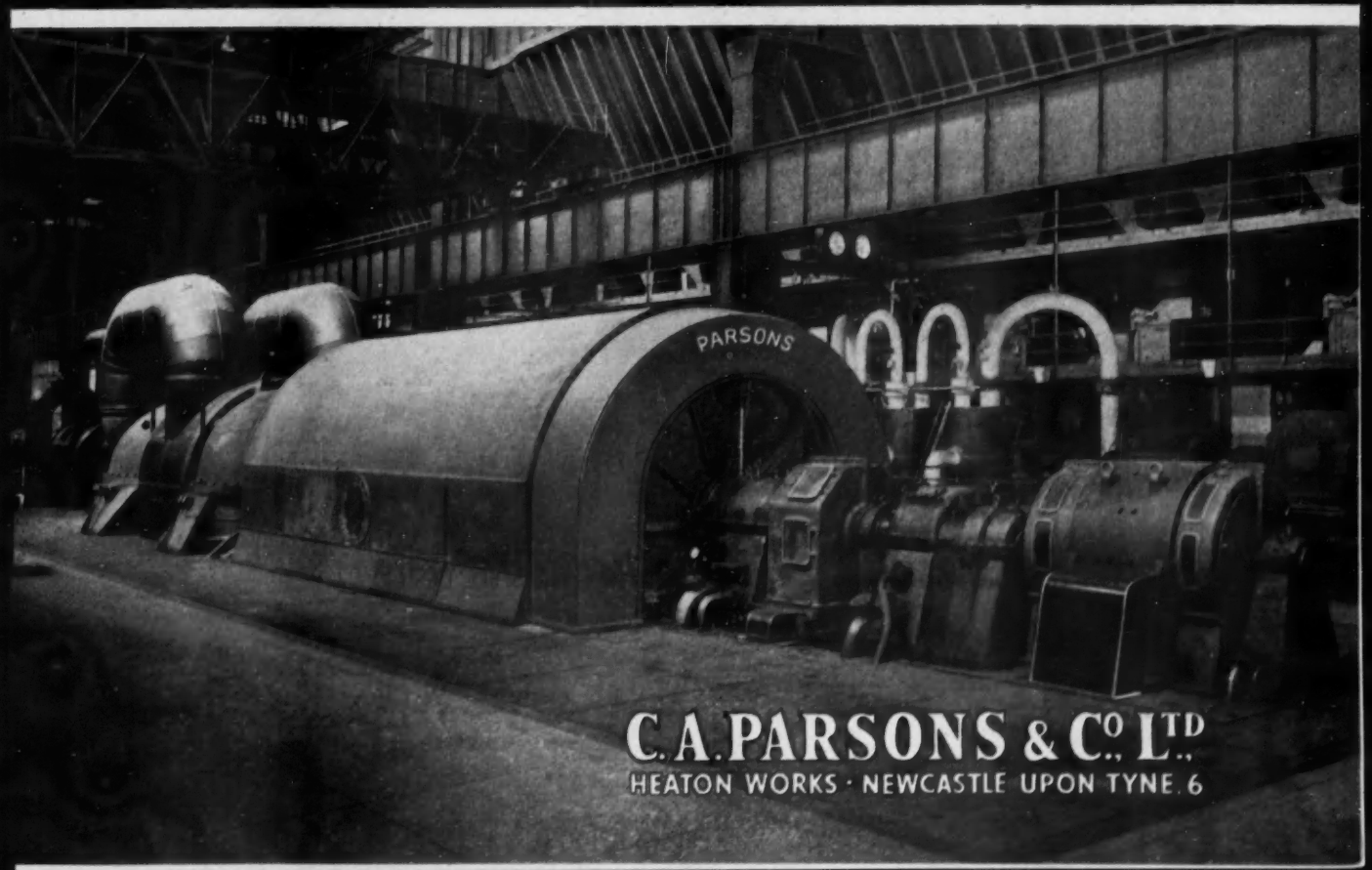

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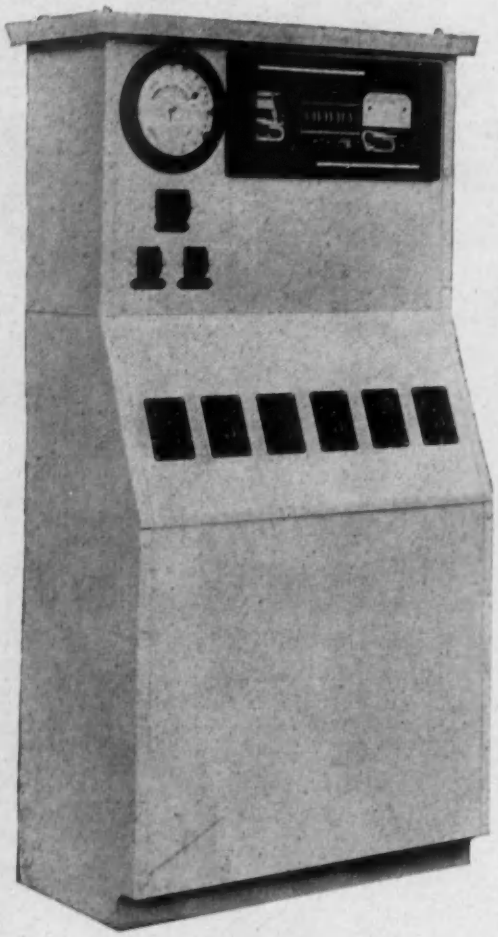

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with all desirable protective features,
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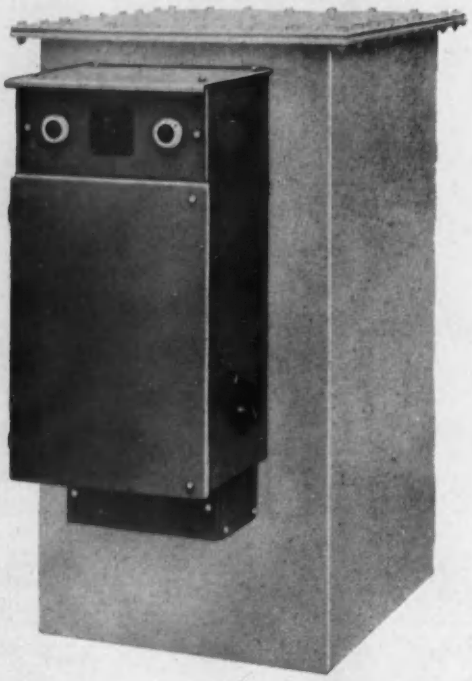

A BELMOS CONTROL DESK
ensures that the required power factor
is automatically maintained.

BELMOS CONTROL GEAR
is being specified as standard equipment
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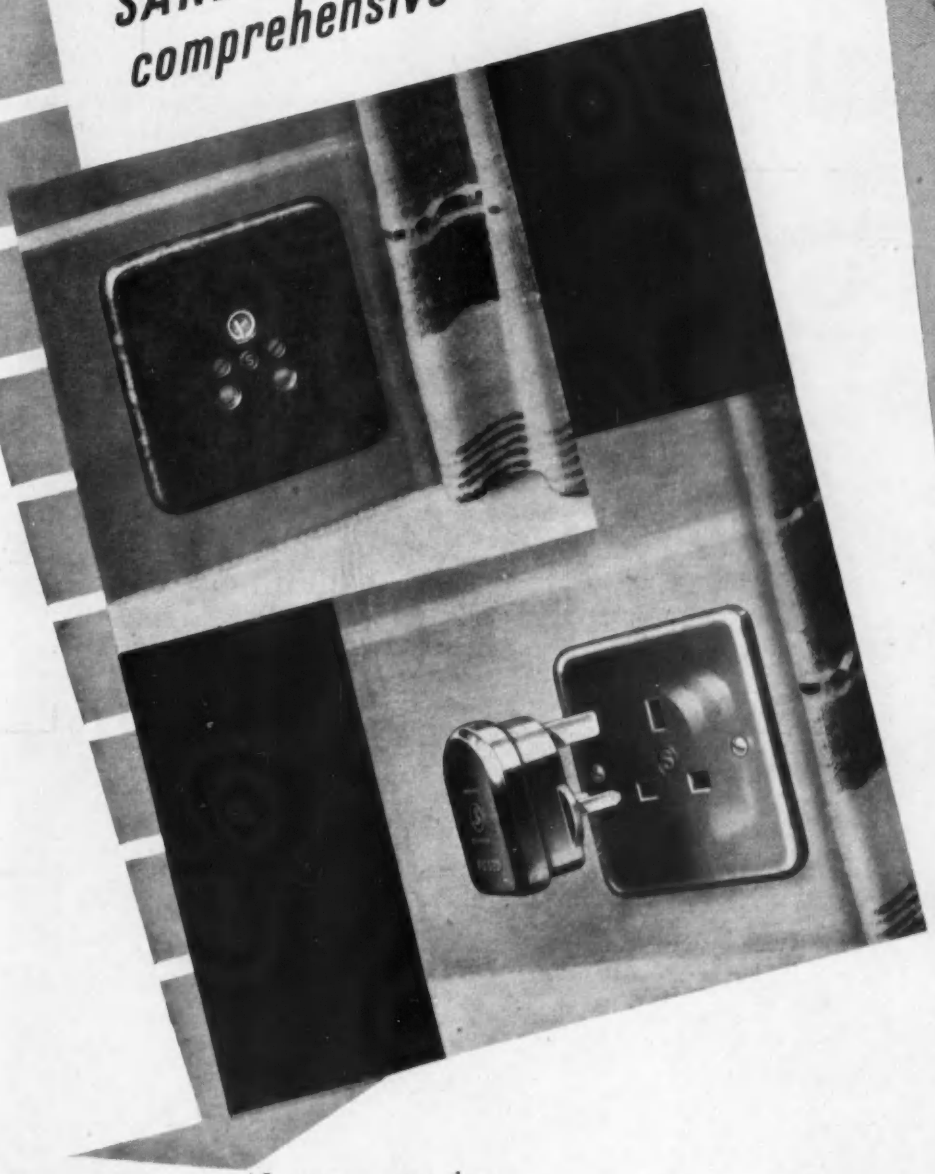

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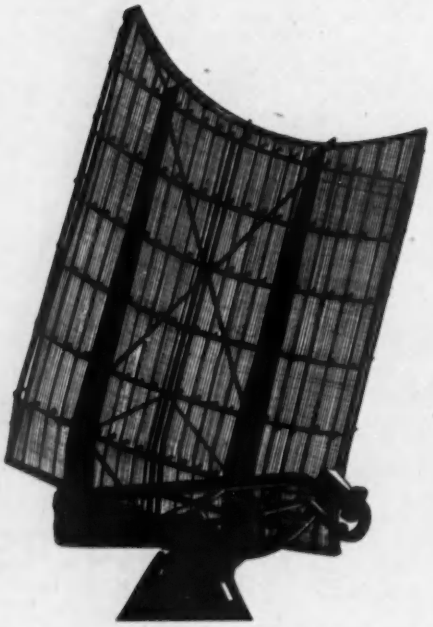

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The corrosion-resistance, non-magnetic properties and mechanical strength of "Staybrite" steels are solving major problems for the electronic engineer just as they have for specialists in the fields of power generation and distribution. Examine the unique features of the "Staybrite" family of steels against your problem.

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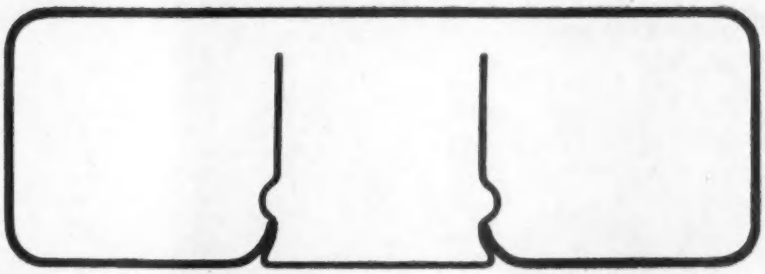

FULL SIZE SECTION
(In Steel)
Can be supplied in extruded aluminium in slightly thicker section.

SHALLOW *lighting trunking*

Leading Contractors enthusiastically endorse the superiority of the new Ediswan shallow lighting trunking. In addition to the facilities commonly offered by trunking systems it has several unique features including an unobtrusive appearance which allows its use in decorated interiors. And the cost is low.

FOR FACTORIES OFFICES AND STORES

For all standard Lighting Fittings. Ediswan trunking is robust, easy to handle and to install. It consists of 4½″ wide by 1½″ deep 18 swg. "Bonderised" and enamelled steel channel in 13ft. lengths. These are coupled together by junction pieces to form a continuous run along which any standard type of lighting fittings (tungsten, fluorescent or mercury discharge) can be positioned as required. Snap-in cover strips are used to seal the trunking between fittings.

For the support of the lighting fittings there is a carrier plate of unique design, which is secured in any desired position by two bonding screws (these also ensure the low resistance earthing essential for instant start circuits), providing female entry for ¾″ conduit.

For other power operated equipment. Lighting fittings, all types of light duty power operated equipment, or socket or conduit outlets from which such equipment can be fed, can be directly attached by use of the carrier plate and standard conduit accessories.

Large enclosed cable ducts—conduit outlets in any direction. The whole of the interior is available for cable, the two large outer ducts taking principal circuits and the middle, the inter-connections between fittings. The dimensions of the trunking also allow for conduit outlets in any direction. The provision of connector blocks makes it simple to alter the layout of lighting or other equipment. A 4-way 2-pole connector block (patent applied for) specially designed for use in trunking can be supplied if required. A unique feature of Ediswan trunking is the space available for handling wiring after the original installation has been completed because the interior walls which create the three separate ducts are part of the cover strip. They are therefore withdrawn when the cover strip is removed and there is ample space for manipulation.

Suspension, Surface Mounting, Recessing. Ediswan shallow trunking is suitable for all normal methods of suspension; for new buildings it may be incorporated in concrete to form a flush surface, or recessed in plaster or acoustic tile ceilings. Because of its smooth, unobtrusive appearance it is particularly suitable for use in Departmental Stores or Offices.

Cut Costs *Trunking systems of any type normally show substantial savings due to lower labour costs, fewer suspension points, and the elimination of multiple conduit runs. Ediswan shallow trunking gives additional valuable savings because it is designed for use with standard conduit accessories and suits standard lighting fittings—and the cost of the trunking itself (in steel) is only 3/1d. per foot approx. (in 0.1″ extruded aluminium approx. 5/5d. per foot) plus accessories.*

Covered by Patent Applications Nos. 20825/54 30248/54

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It may be a School, it may be a Factory—a Power Station or a Housing Estate, but more often than not the electrical specification will be—METALLIC.

This Yorkshire building is no exception, being fitted throughout with METALLIC Conduit and Fittings—unequalled for quality and consistent accuracy.

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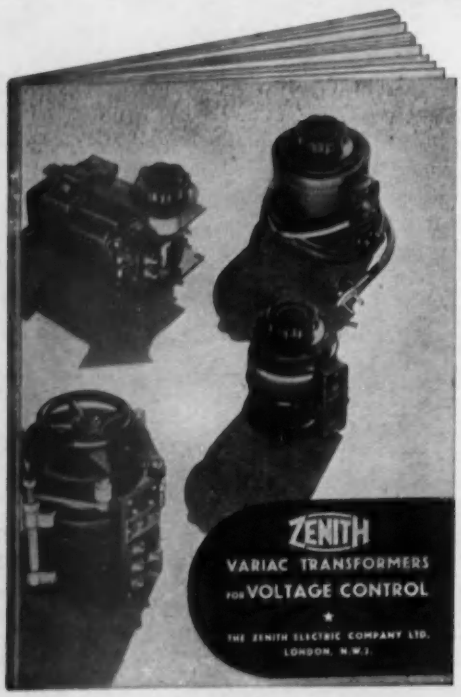

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All VARIAC-DURATRAK Variable Voltage Transformers have a brush track treated in accordance with British Patent No. 693406, which produces a coating of precious metal alloy on the brush track surface, eliminating the possibility of deterioration due to oxydization, and reducing contact resistance.

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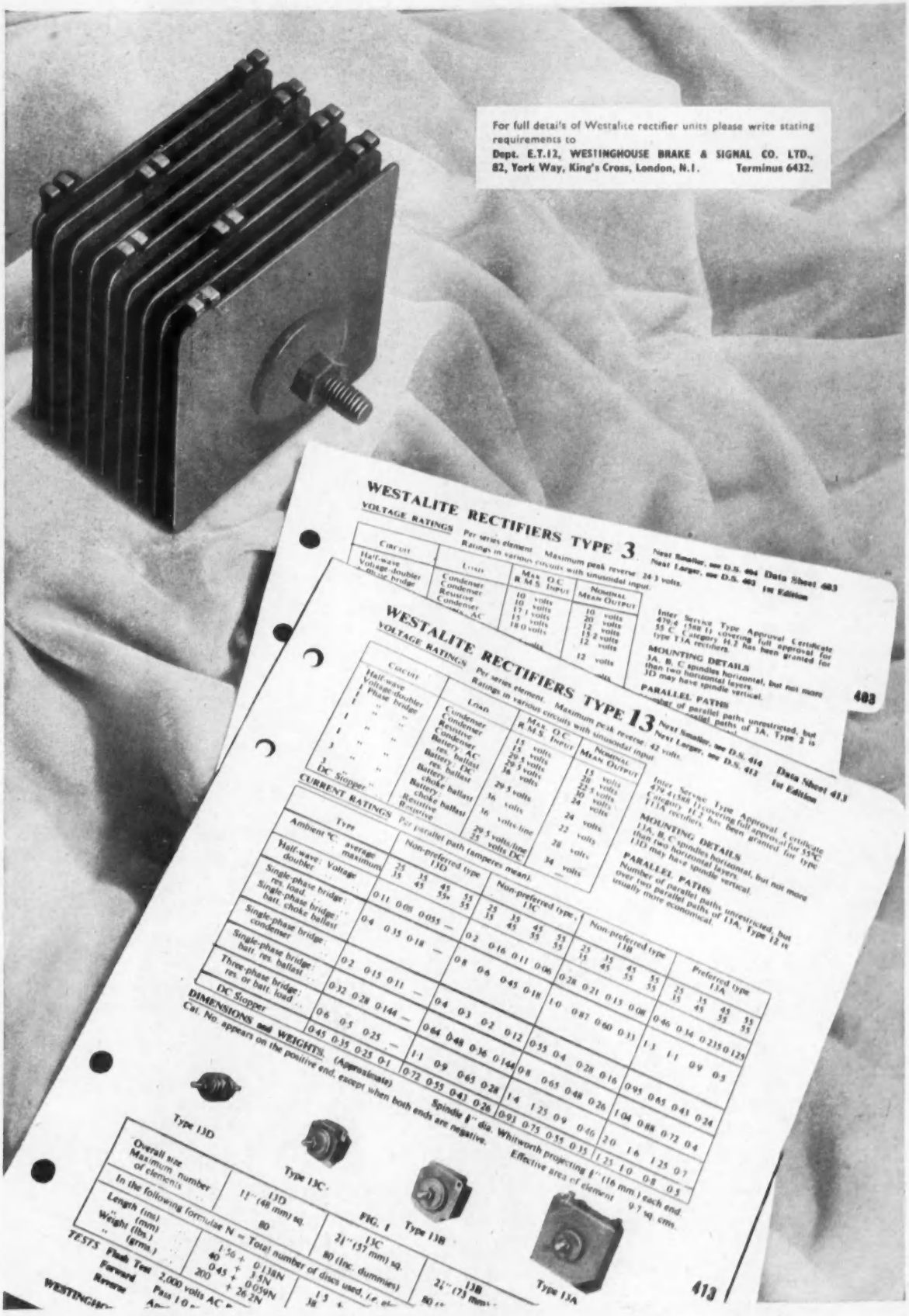
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Dept. E.T.12, WESTINGHOUSE BRAKE & SIGNAL CO. LTD.,
82, York Way, King's Cross, London, N.1. Terminus 6432.
WESTALITE RECTIFIERS TYPE 3
Next Smaller, see D.S. 484 Data Sheet 483
Next Larger, see D.S. 483 1st Edition
VOLTAGE RATINGS
Per series element. Maximum peak reverse 24·3 volts.
Ratings in various circuits with sinusoidal input.
Circuit
Loads
Max. D.C. R.M.S. Input
Nominal Mean Output
Half-wave
Voltage-doubler
Bridge
Condenser
Condenser
Resistive
Condenser
10 volts
10 volts
13·1 volts
15·1 volts
18·0 volts
10 volts
20 volts
12 volts
15·2 volts
12 volts
12 volts
Inter Service Type Approval Certificate 470/4 (588 1) covering full approval for 55°C Category 56.2 has been granted for type T3A rectifiers.
MOUNTING DETAILS
3A, B, C spindles horizontal, but not more than two horizontal layers.
3D may have spindle vertical.
PARALLEL PATHS
Number of parallel paths unrestricted, but usually more economical. Type 3 is equivalent to parallel paths of 3A, Type 2 is equivalent to parallel paths of 3B.
483
WESTALITE RECTIFIERS TYPE 13
Next Smaller, see D.S. 414
Next Larger, see D.S. 413
Data Sheet 413
1st Edition
VOLTAGE RATINGS
Per series element. Maximum peak reverse: 42 volts.
Ratings in various circuits with sinusoidal input.
Circuit
Loads
Max. D.C. R.M.S. Input
Nominal Mean Output
Half-wave
Voltage-doubler
1 Phase bridge
1 " "
2 " "
3 " "
3 " "
DC Stopper
Condenser
Condenser
Resistive
Condenser, AC
Battery + choke ballast
Battery, DC res. ballast
Battery, choke ballast
Battery, Resistive
Resistive
15 volts
15 volts
29·5 volts
29·5 volts
38 volts
29·5 volts
36 volts
36 volts line
29·5 volts line
25 volts DC
15 volts
20 volts
22·5 volts
30 volts
24 volts
24 volts
22 volts
28 volts
34 volts
Inter Service Type Approval Certificate 470/4 (1588 1) covering full approval for 55°C Category 56.2 has been granted for type T13A rectifiers.
MOUNTING DETAILS
13A, B, C spindles horizontal, but not more than two horizontal layers.
13D may have spindle vertical.
PARALLEL PATHS
Number of parallel paths unrestricted, but over two parallel paths of 13A, Type 12 is usually more economical.
CURRENT RATINGS
Per parallel path (amperes mean).
Type
Ambient °C: average
maximum
Non-preferred type 13D
25 35 45 55
35 45 55 55
Non-preferred type 13C
25 35 45 55
35 45 55 55
Non-preferred type 13B
25 35 45 55
35 45 55 55
Preferred type 13A
25 35 45 55
35 45 55 55
Half-wave: Voltage-doubler
0·11 0·08 0·055 —
0·2 0·16 0·11 0·08
0·28 0·21 0·15 0·08
0·46 0·34 0·235 0·125
Single-phase bridge: res. load
Single-phase bridge: batt. choke ballast
0·4 0·35 0·18 —
0·8 0·6 0·45 0·18
1·0 0·87 0·60 0·33
1·3 1·1 0·9 0·5
Single-phase bridge: condenser
Single-phase bridge: batt. res. ballast
0·2 0·15 0·11 —
0·4 0·3 0·2 0·12
0·55 0·4 0·28 0·16
0·95 0·65 0·43 0·24
Three-phase bridge: res. or batt. load
0·32 0·28 0·144 —
0·64 0·48 0·36 0·144
0·8 0·65 0·48 0·26
1·04 0·88 0·72 0·4
DC Stopper
0·6 0·5 0·25 —
1·1 0·9 0·65 0·28
1·4 1·25 0·9 0·46
2·0 1·6 1·25 0·7
0·45 0·35 0·25 0·1
0·72 0·55 0·43 0·26
0·93 0·75 0·55 0·35
1·25 1·0 0·8 0·5
DIMENSIONS and WEIGHTS. (Approximate)
Cat. No. appears on the positive end, except when both ends are negative.
Spindle ¼" dia. Whitworth projecting ⅝" (16 mm.) each end.
Effective area of element 9·7 sq. cms.
Type 13D
Type 13C
Type 13B
Type 13A
FIG. 1
Overall size
Maximum number of elements
13D 1⅞" (48 mm) sq. 80
13C 2¼" (57 mm) sq. 80 (inc. dummies)
13B 2⅞" (73 mm) sq.
In the following formulae N = Total number of discs used, i.e. el
Length (ins) (mm)
Weight (lbs.) (grms.)
1·56 + 0·118N
40 + 3·5N
0·45 + 0·039N
200 + 26·2N
1·5 +
38 +
TESTS. Flash Test
Forward
Reverse
2,000 volts AC
Pass 10
413
WESTINGHOUSE

four aces for the live dealer
Hotpoint
Hotpoint equipment for home laundry is built to the highest electrical standards of safety and reliability. Washing machine, rotary and table ironers and clothes dryer are designed for attractive appearance and simple efficiency. Hotpoint have created a demand for their products which ensures continuous business and customer confidence.
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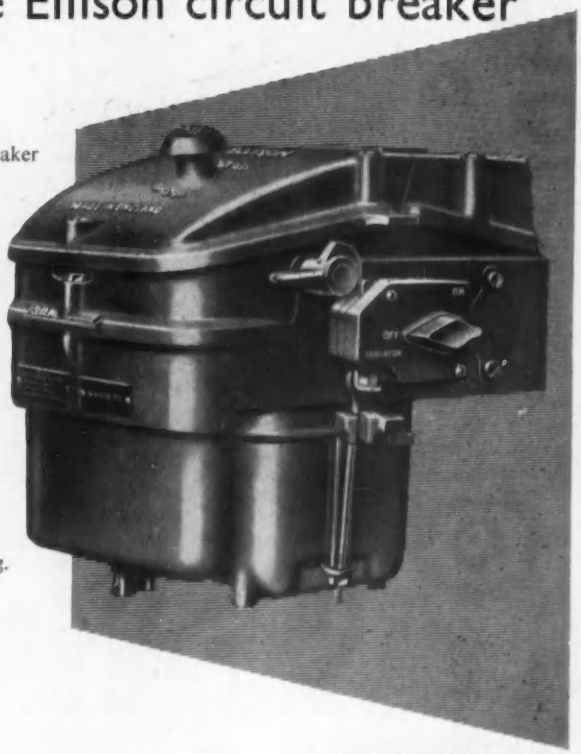
★Direct-to-line starting

★Feeder circuits protected

SIMPLE-SAFE

with the Ellison circuit breaker

The new A.S.T.A. Tested Ellison Circuit breaker and starter is rated at 20 amps and is suitable for voltages of up to 660
Easy to install and maintain, it features a built-in isolator quick resetting overcurrent protective devices and a simple interlock between breaker and isolator . . . the long-life contacts are specially suitable for direct-to-line starting.
Optional extras include H.R.C. back-up fuses and auxiliary switches, complete interlock between the breaker lid, tank and isolator, and combined pedestal and cabling trunk for floormounting.



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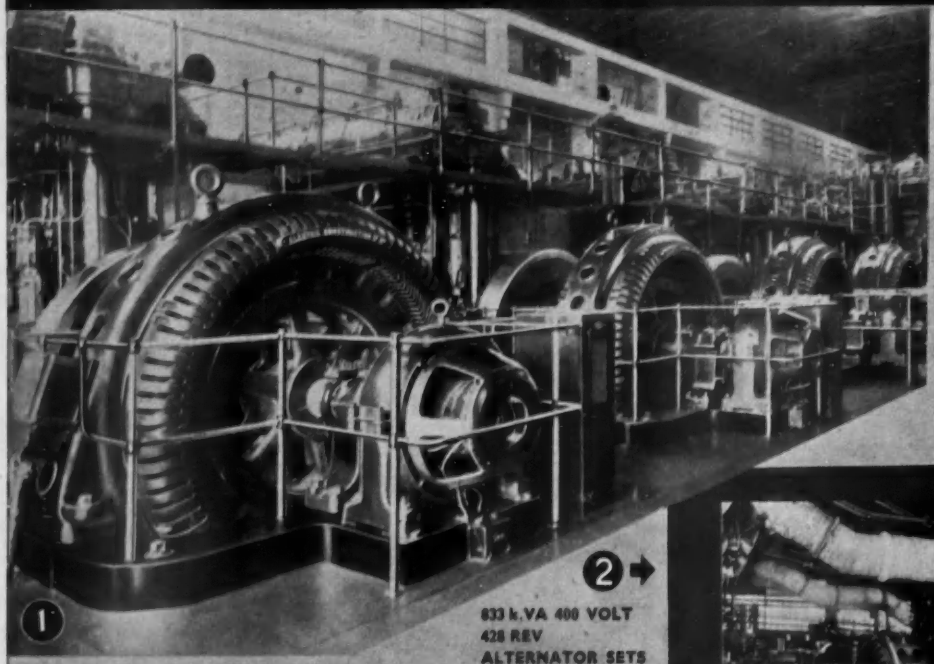

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6kV DIESEL-ENGINE DRIVEN ALTERNATOR SETS AT THE QUEEN'S ROAD (ST. HELIER) GENERATING STATION OF THE JERSEY ELECTRICITY SUPPLY COMPANY LTD.

2 →

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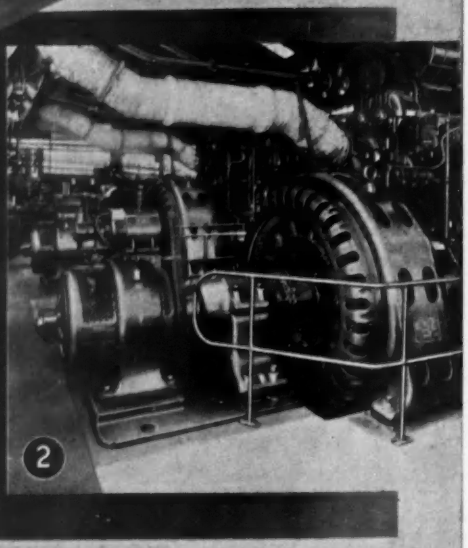

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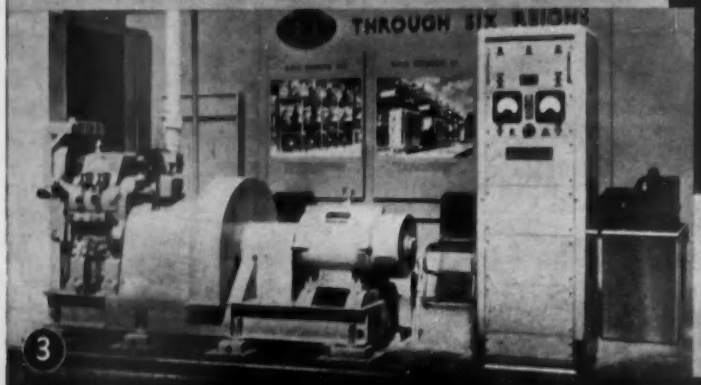

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URGENT AUTOMATION

One of the many paradoxes that beset our contemporary society arises from the progress of technology. Increased specialisation is essential to speed up discovery and skill in application of each new technique, yet the welding together of these skills to meet the demands that modern civilisation makes on science requires men with a broad grasp of the whole field of engineering. There is no single answer to this problem. It is only by continuing efforts to maintain contact and promote co-operation between all branches of engineering that advance can be made. One element in the advance in this direction is an increasing unity of approach to joint problems by leading engineering institutions at both a national and international level. This theme of the interdependency of engineers was developed last week by Sir Harold Hartley, who delivered the first lecture in a series which is to commemorate Graham Clark, a former secretary of the Institution of Civil Engineers, who did much to forward such co-operation. Sir Harold's subject permitted him the broad sweep appropriate to an inaugural lecture. He dealt with the engineer's contribution to the urgent task of conserving natural resources. For the electrical engineer perhaps the most striking suggestion is to be found at the end of this lecture, where Sir Harold turned to the most precious of all resources, skilled labour. The emphasis here was placed on the need to develop control engineering, "automation" as it is now being called. Sir Harold expressed concern that there is greater awareness of the urgency of developing this technique in America and Russia than there is in this country. This is a sharp note of warning from so eminent a scientist. Although it is addressed to all branches of engineering, the initiative lies undoubtedly with the electrical engineer. Some notable work has been done in this field already, but there is extreme urgency that this be extended.

SLOW AHEAD

The first signs of implementation of British Railways' plan for large-scale reorganisation are disappointing. Orders have been placed for one hundred and seventy main line diesel (or diesel-electric) locos for experimental purposes, extensions to certain suburban networks are given the all clear, but of the two main line electrification projects there is no more than cautious agreement to take the "first steps" towards the preparation of one of them. While we do not wish to underrate the extent of the work involved in such a project, considerable preliminary work should have already been done.

It is surprising that no orders have been placed for experimental main line electric locos. Is the Railway Executive satisfied with the design of the Sheffield-Manchester locos or is the progressing of the main line project to be sufficiently leisurely to allow more than ample time for such vital exploratory work? Alternatively, perhaps consideration is being given to the design and production of the locos in the Executive's own workshops. Does not the situation demand a more dynamic approach to electrification? French experience shows that loco design is the key to efficient electrification and extensive running trials on alternative designs are necessary to achieve the best compromise between cost and efficiency.

SOLVING SHAFT TROUBLES

One of the major causes of turbine outage, particularly over the past decade, has been distortion of h.p. shafts. Supervisory gear for the warning and identification of shaft unbalance has indeed become almost a standard requirement for the larger machines now coming into use. But although supervisory gear can give an indication of the development of vibration and deflection, it is mainly of practical importance during the running up period when shaft distortion is caused by transient thermal gradients in cylinders and shafts. It has, however, been found that in certain cases a deflection arises which is not transient but which is dependent on the temperature of the shaft itself. With the present acceptance of 1,000° F as a normal steam temperature, and the possibility of increases to 1,050 or 1,100° F in the near future, the elimination of this type of bending becomes worthy of the closest investigation. The results of work on this phenomenon were described in a recent paper presented at the Institution of Mechanical Engineers, and the authors were noteworthy in that they not only gave a theory to account for the bending, but also described a cure. The solution proposed, which involves a variation in heat treatment to ensure that the metallurgical composition of the shaft is consistent throughout, is restricted to the elimination of temperature deflection only. It is still a considerable step forward. The paper quotes that out of twenty shafts received by a turbine manufacturer, three showed this defect, and while such a figure cannot be taken as being generally applicable, it indicates that many past troubles must have stemmed from this cause.

INDUCTION SPEEDS PRODUCTION

Employment of induction heating in a steel rolling mill marks a new advance in the size scale for this method of electrically heating metal objects. Induction heating has been used successfully for reheating billets in forging tools, but its application to medium-sized ingots in a Canadian steel mill, which we describe this week, brings this technique within the realm of heavy industry. The new development shows clearly the advantages that can follow from the introduction of electricity into such work. Speed, cleanliness, flexibility of operation and easier working conditions are all advances on the batch heating in oil-fired furnaces previously employed. Although the energy demand of this application is relatively small when measured against the immense requirements of the electro-chemical industry, the importance of this latest advance cannot be judged by this factor alone. Its significance lies rather in the fact that electro-heating has made another step forward in the steel industry. It is gradual penetration of this sector of industry that can give electricity supply one of its most valuable high load factor loads.

RESEARCH FOR THE HOME

Usually the annual report of the Electrical Research Association impresses by its range of technical results from investigations into advanced problems of technology. Ample evidence of successful work at this level is certainly not lacking in the report for 1954 which was published last week, but for once this does not steal the limelight. Rather, the attention is captured by the work carried out on the more homely applications of electricity. Pride of place must be given to the heat pump, which in its capacity as a joint water heater/larder cooler attracted such attention during the year under review, and continues to do so. After the war the E.R.A. devoted much time and energy to investigating the possibilities and problems of the heat pump, and it understandably claims a share of the credit for present developments. Floor heating is another rapidly developing field where the Association is active in research and development. Attention is focused on existing installations, and the work is mainly measurement and analysis, but the Association is making its own contribution to this developing technique by installing a carefully instrumented floor heating scheme in its new laboratories, now building at Leatherhead. There are strong hopes also of development in the field of drying and airing laundry. What is particularly pleasing about all this work is its promise for the future of new facts where old theories have previously had to suffice. It is on the availability of such information, and on its exploitation by the industry's salesmen, that the future expansion of domestic electrification to some degree depends.

TOURIST VALUE

The very mention of hydro-electric development is usually enough to put self-styled country lovers into a turmoil, in the fear that the civil engineering entailed will be the end of the attractiveness of the catchment area concerned. Quite another result is apparent in Australia, where the Snowy Mountains area is being developed in a great hydro scheme, the first section of which was recently officially opened. The roads that have been driven to give access to dam sites and station excavations have had the incidental effect of opening up the area to tourists. Placid reservoirs mirroring the mountains and churning sluices are, in the main, potential attractions of the future. At present, the very work of construction in this wide natural setting is proving sufficient attraction to bring Sydney trippers along on three day rail, air and coach trips organised by the Snowy Mountains Hydro-Electric Authority in conjunction with the New South Wales Government Tourist Bureau. The success of these tours—"early booking is advisable" is the order of the day—repeats the experience of some other hydro authorities that have given attention to the possibilities of tourism.

Meteor

Filters for Rectifier Equipment

A METHOD FOR ASSESSING THE VALUES OF THE PRINCIPAL COMPONENTS

By P. Bingley, *A.M.I.E.E.*

THE resonant shunt filter circuit is used with metal and mercury-arc rectifier equipments for the reduction of harmonic voltages which are normally present on the d.c. side of the equipments. In the following article the circuit and components will be described and a brief theory of operation given. An established formula for the calculation is used and other formulæ are developed, which, when applied in sequence, enable the principal values for the components to be established when the acceptable level of the harmonic voltages is given. The performance of the tuning coils, over the frequency range encountered, is considered in conjunction with the effect on filter ratio, and it is concluded that, except in the case of a filter with a single shunt, a rigid mathematical solution to a particular case may lead to an impractical basis for design.

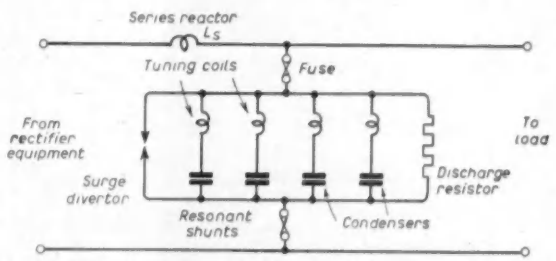

Fig. 1. Schematic diagram showing principal components of resonant shunt filter

A list of symbols used in this article is given below:

a=mean radius of coil, (in.)
b=length of coil, (in.)
c=depth of coil, (in.)
C=capacity of condenser in shunt circuit, (microfarads.)
E_h=r.m.s. harmonic voltage generated, (volt)
f=frequency, (c/s)
I_d=rated current of rectifier equipment, (amp.)
I_h=r.m.s. harmonic current, (amp.)
K=filter ratio,
l=length of conductor, (in.)
L_p=inductance of resonant shunt tuning coil, (millihenry)
L_s=inductance of main series reactor, (millihenry)
L_r=inherent inductance due to rectifier equipment, (millihenry)
N=number of turns
P=factor, dependent on the value of Y
r_h=resistance 1,000 yd wound of conductor at harmonic frequency, (ohm)
R_h=resistance of tuning coil at harmonic frequency, (ohm)
S=gross cross-sectional area of conductor, (sq in.)
V_{do}=theoretical light load voltage of rectifier equipment, (volt)
X_e=percentage reactance for complete rectifier equipment based on primary kVA, for load I_d.
X_s=percentage reactance of supply, when load is I_d.

$$Y=\frac{b+c}{2a}$$

In the above, the affix "h" is used to denote harmonic frequency generally and is replaced by a number when it is desired to denote a particular harmonic frequency.

General Problem

The commonest type of filter used in conjunction with mercury-arc or metal rectifier equipments is known as a resonant shunt filter; it is incorporated whenever the magnitudes of the harmonic voltages generated by a rectifier equipment cannot be tolerated in the load circuit, and reduction to an acceptable level is desired.

The arrangement usually comprises a series (air-core) reactor, a number of resonant shunts, a surge divertor, a discharge resistor and protective fuses. Each resonant shunt consists of a condenser and a tuning coil (also air-core).

A typical circuit is shown in Fig. 1. If desired, the resonant shunts may be protected individually by fuses, instead of in a group as illustrated.

The values of the several important harmonic voltages generated having been established, the general problem is so to proportion the elements of the filter, that the required reduction for each harmonic voltage is achieved with best use of materials. The problem has no single solution, but a good design will necessitate a balance between such considerations as the cost of main series reactor; the cost of all condensers; possible variations in supply frequency; filter characteristics of adjacent equipment (if any), and layout possibilities.

The discharge resistor, surge divertor, fuses, and also generally the tuning coils, are all relatively small and inexpensive components compared with the main series reactor and the condenser banks; thus it is important to establish the size of these two components at the onset.

Brief Theory of Operation

If the harmonic voltages generated are considered individually, the equivalent circuit for the filter may be represented as shown in Fig. 2. The shunt portion of the filter comprising L_p, C and R is tuned to resonate at the frequency of the particular harmonic voltage, E_h, under con-

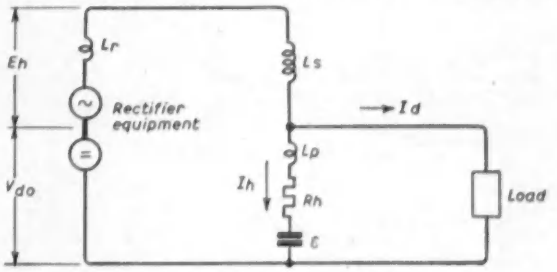

Fig. 2. Equivalent circuit of filter

sideration, and thus provides a path of low impedance for the harmonic current, I_h.

The reactance of the main series reactor prevents the current from reaching an excessive value, and the major portion of the unwanted harmonic voltage will thus appear across the reactor itself. Due to losses in the resonant shunt, the remainder of the harmonic voltage appears across the load circuit which is in parallel with L_p, C and R.

The true filter ratio (for a particular frequency) is the ratio of the harmonic voltage generated, to that appearing across the load circuit, but since the voltage drop due to resistance in the main series reactor will be small compared with that due to reactance, and further, since the voltage drop due to the resistance of the tuning coil will be large compared with other voltage drops in the shunt circuit under conditions of resonance, it is generally sufficiently accurate to define filter ratio as:

$$K_h = 2\pi f_h L_s \times 10^3 / R_h \qquad \text{.....(1)}$$

Worthy of note at this stage is the peak voltage across the condensers, which will be given by:

$$1{\cdot}2\ V_{do} + \left(\frac{E_h}{R_h} \cdot \frac{\sqrt{2}\times 10^3}{2\pi f_h C}\right) \text{approximately} \qquad \text{.....(2)}$$

In the above formula, the factor 1·2 allows for the voltage rise at light load which is characteristic of equipments incorporating interphase reactors.

Influence of the Effective Resistance of Tuning Coils on Filter Ratio

Equation (1) demonstrates the importance of keeping the value R_h low, in order to maintain a high filter ratio. Particular consideration is therefore to be given to the type of wire to be used for the tuning coil. Fig. 3 illustrates the nature of the results obtained if plain stranded wire is used in the manufacture of coils of approximately square cross-section, wound with a single conductor. The wire actually used was 19/·052 in. d.c.c. overall.

If a finely stranded, transposed, conductor is used, which has each strand or group of strands insulated, the results indicated in Fig. 3 are improved upon by an amount depending largely upon the arrangement of the conductor used. However, since coil geometry may affect the results, it is preferable to adhere to a series of dimensional ratios which with one or two variations may be repeated in the majority of filters designed. Golding[1] mentions that maximum inductance for a given length of wire is obtained, if the coil can be made circular in cross-section and with the radius of circular axis 2·575 times greater than the radius of the cross-section itself.

Most designs can be covered adequately by using coils of square cross-section; alternatively a rectangular cross-section with the coil length dimension twice that for coil depth may be used. It is then possible to prepare curves similar to those given in Fig. 3, which should be sufficiently accurate for all normal design purposes.

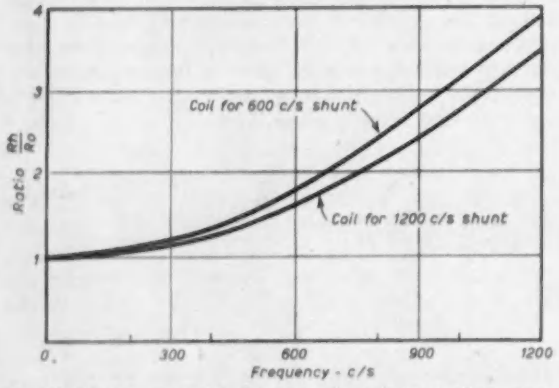

Fig. 3. Effective resistance of tuning coils at harmonic frequencies

Interconnections are also subject to resistance increase with frequency increase, and the filter unit should be arranged physically so that these interconnections are kept as short as possible. For preference these should be made with conductors of a type similar to that used in the tuning coils themselves.

Harmonic Voltages Generated

The amplitudes of the important harmonic voltages for usual values of circuit reactance are given in Fig. 4. For detailed information, the paper by Read[2] may be consulted.

In Fig. 4, the ordinates are scaled so that the values of E_h appear as percentages of the theoretical light-load voltage V_{do}, and the abscissæ are scaled in the sum of the equipment reactance X_e plus the reactance of the supply X_s. The value X_e may be greater than the actual transformer reactance in cases where reactors are used in the anode circuits of the rectifier for the adjustment of load balance between different rectifier groups or between anodes which conduct simultaneously.

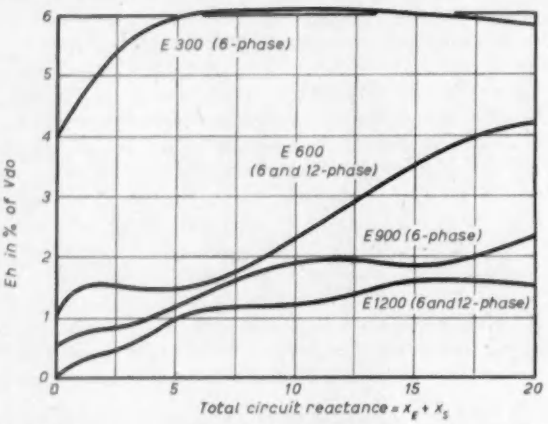

Fig. 4. Harmonics appearing in the d.c. output of six- and twelve-phase equipments

When obtaining values of E_h for 12-phase equipments, the actual values of X_e+X_s should be halved before using the curves in Fig. 4.

The value of V_{do} for an existing equipment may be obtained by multiplying the transformer phase-neutral voltage by one of the following factors: 1·17 for 6- and 12-phase equipments with interphase reactors; and 1·35 for 6-phase equipments without interphase reactors.

Main Series Reactor

The formulæ and curves given later enable the main dimensions to be calculated but it is to be noted that, as the rectifier and the anode circuits possess inductance inherently, the effective series inductance in the main d.c. circuit is always greater than that due to the main series reactor alone.

For small industrial equipments operating at low voltages, the value of this inherent inductance may be negligible, but for equipments working at higher voltages, especially when 12-phase connections are used, it may well be appreciable, and filters have been designed for such equipments, omitting the main series reactor altogether.

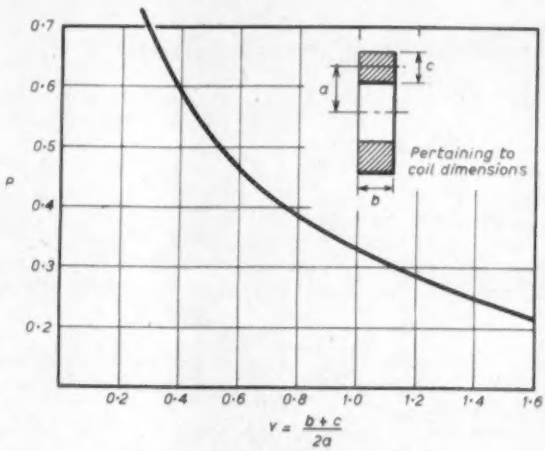

Fig. 5. Relationship between Y and P

Read[2] gives the approximate average value of the inherent inductance due to rectifier equipments with conventional 6- and 12-phase connections as:

$$L_r=\frac{V_{do}}{10\pi I_d}.(X_c+X_s) \quad \text{millihenry} \qquad \text{.....(3)}$$

Tuning Coil Design

Inductance of coils.

When the coils are being designed, the main consideration will be the effective resistance at the operating frequency, and this consideration usually over-rides all others pertaining to the shunt portion of the circuit.

It is essential therefore to establish the relationship between (*a*) coil geometry; (*b*) coil inductance; (*c*) length of conductor, and hence (*d*) d.c. resistance of the coil.

A general formula for inductance is given by Marti and Winograd[3] as $L=a\,N^2\,P\times10^{-4}$ millihenry .....(4)

The value for P is dependent upon the coil geometry. Fig. 5 shows the relationship beween $Y=\frac{b+c}{2a}$ and P. Experience shows a convenient value of Y to be 0·7, thus P will be 0·42.

Coil Dimensions.

Assuming a coil of square cross-section so that $b=c$, it can be shown that

$$a=\sqrt[5]{9{\cdot}91.\,L.\,S^2\times10^4} \qquad \text{.....(5a)}$$

or, if $b=2c$,

$$a=\sqrt[5]{12{\cdot}6.\,L.\,S^2\times10^4} \qquad \text{.....(5b)}$$

from a all other dimensions are deducible and it is then necessary to establish the length of conductor required to wind each particular tuning coil.

For a uniformly wound coil, $l=2\pi aN$ and by substitution in equation (4) it can be shown that:

if $b=c$

$$l=85{\cdot}2.\,L^{0{\cdot}6}.\,S^{0{\cdot}2} \text{ (yd)} \qquad \text{.....(6a)}$$

or, if $b=2c$

$$l=86{\cdot}5.\,L^{0{\cdot}6}.\,S^{0{\cdot}2} \text{ (yd)} \qquad \text{.....(6b)}$$

Determination of Ls and C

So far, the formulæ given do not indicate a relationship between L_s and C. The method given here takes into account the characteristics of the tuning coil at its working frequency. A comparison may thus be made between the inductance of the main series reactor and the capacity of the condenser for the resonant shunt working at the lowest frequency: this is the first step in proportioning the filter unit.

From equation (1), $L_s=\frac{K_h\,.\,R_h}{\omega}\times10^3$ millihenry, having given the data for the type of conductor to be used for the tuning coils, and in particular the overall diameter and the resistance/1,000 yd, which is corrected for the working frequency from the curves described earlier, an equation may be obtained for each form of coil adopted.

Using for example equation (6a),

$$R_h=85{\cdot}2\,L^{0{\cdot}6}\,S^{0{\cdot}2}\,r_h\times10^{-3} \text{ (ohm)}$$

and because at resonance $L=\frac{10^9}{\omega^2C}$

$$R_h=85{\cdot}2\,S^{0{\cdot}2}\,r_h\left(\frac{10^9}{\omega^2C}\right)^{0{\cdot}6}\times10^{-3} \text{ (ohm)}$$

from equation (1) is thus obtained:

$$L_s=\frac{K_h 85{\cdot}2\,S^{0{\cdot}2}\,r_h\left(\frac{10^9}{\omega^2C}\right)^{0{\cdot}6}\times10^{-3}}{\omega}\times10^3 \text{ (mH)}$$

$$=K_h\frac{85{\cdot}2\,S^{0{\cdot}2}\,r_h\,10^{9{\cdot}6}}{\omega^{3{\cdot}6}\,C^{0{\cdot}6}} \text{ (mH)}$$

for a particular resonant shunt having a tuning coil as indicated above, therefore,

$$L_s=\frac{k}{C^{0{\cdot}6}} \text{ where "}k\text{" is a constant.}$$

It is impractical to calculate exact values of L_s and C to give a minimum cost filter since the rigid solution thus obtained is not necessarily an acceptable one. For example, it is essential to ensure that any one condenser does not resonate against the combined reactance of its own tuning coil plus that of the main series reactor. It is good practice to allow for a 25% change in frequency before this condition is reached.

Other Components

The surge diverter is selected having regard to the maximum values of transient voltage to which the condensers may be exposed and the nature of the system to be fed. The most onerous conditions are generally found where traction substations feed overhead systems.

The discharge resistor, while not essential to the operation of the filter, is provided for reasons of safety. It is conventional to arrange a discharge circuit for the condensers so that, if the filter is isolated, intentionally or as the result of a blown fuse, the terminal voltage of the filter as a whole is reduced to about 50 V in one minute.

For convenience, fuses are often of the same type used in the rectifier equipment itself and are arranged to protect the unit against short-circuits only.

Conclusion

The economical design of a filter which has more than one resonant shunt does not lend itself to a rigid mathematical solution.

To reduce the trial and error process during design it is possible to arrive at a reasonably exact relationship between the size of the main series reactor and the size of the condenser associated with the shunt circuit for the lowest frequency. Hence a guide to the size of the other condensers is obtained.

The t.h.f. calculations and loss calculations referred to in B.S.1698:1950, "Mercury-arc Rectifier Equipments," hold good only so long as it is established that, at the harmonic frequencies, the increase in resistance of the shunt circuits is negligible.

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Professional Co-operation Brings Conservation

WITH the ever-increasing move toward specialisation in engineering, there is a corresponding growth in the need for common understanding between different engineering interests to maintain the essential unity of the engineering profession. It was to this end that Graham Clarke, Secretary of the Institution of Civil Engineers, devoted a substantial proportion of his time and energy, and, as a means of fostering this mutual co-operation, he suggested lectures on subjects of common interest to the three major engineering Institutions. To both commemorate the man and implement the suggestion, the Civils have established an annual Graham Clark lecture, and last week saw Sir Harold Hartley K.C.V.O., F.R.S., delivering the inaugural lecture at their Institution.

To illustrate the underlying theme of professional co-operation, Sir Harold surveyed the engineer's contribution to the conservation of natural resources, interpreting his title in the broader sense to embrace virtually all the engineering technologies. Basically, the natural resources on which civilisation has been built and which are, today, proving the limiting factors in development and supplying the world's food are soil and water, and the conservation of the latter, particularly, has the highest priority. Of the earth's total water content, some 98% is in the sea. Of the rest, 98% is frozen in the polar ice caps, leaving only some 0·04% of the total in rivers and lakes, and only one part in 100,000 in the hydrologic cycle in the atmosphere.

Water conservation, in the form of irrigation, is one of the oldest engineering occupations; and it is now extended to multi-purpose schemes of water control—embracing flood prevention; power generation; irrigation and transport. Classical of such schemes is that of the Tennessee Valley, although many similar projects are either completed or under construction in other parts of the world. Kemano-Kitimat, in the Canadian Rocky Mountains, will eventually provide 1,700 MW; the Dokan Dam, on the Lesser Zab River in Mesopotamia, some 143 MW; Africa's Volta River project, to give some 580 MW, and the Snowy Mountain scheme of Australia, where some 3,000 MW is projected, are but a few examples, most of these schemes also providing extensive irrigation. To complete this picture is associated work of forestation, ground cover and terracing to prevent soil run-off and the consequent silting of reservoirs.

For industrial and urban use, however, water is now limiting development and in Britain it is already difficult to find inland sites with cooling water for power stations. Nuclear power stations will almost certainly be sited by the sea.

Following a review which ranged from energy conservation to efficient use of materials in engineering he concluded by referring to the development of automatic control systems for conserving human effort. He pointed out that if the maximum advantage is to be made of these new techniques, its philosophy and theory must start in the design stage and be applied continuously. Developments abroad, particularly in the U.S.A. and Russia, indicate an urgent need for a more active and general recognition of the future importance of control engineering in this country.

The Bending of Turbine Shafts

TEMPERATURE can play an important part in causing turbine shafts to bend. Three types of bending have been recognised. One is transient and occurs only when the temperature of the shaft is changing: one is a permanent deflection and is due to the relief of non-axial residual stresses on the heating up of a new shaft, and the third is a deflection dependant on temperature.

An investigation into this third type was described by Messrs A. Barker and F. W. Jones at a recent meeting of the Institution of Mechanical Engineers. The experimental work was carried out with the co-operation of Messrs C. A. Parsons and Co., Ltd., the authors being, however, with the Brown-Firth Research Laboratories.

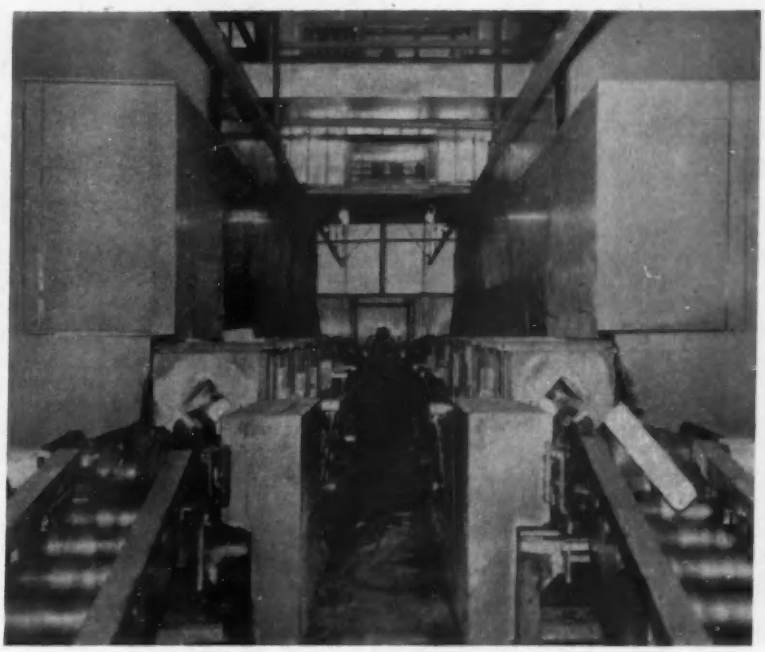
Experimental Work

Initial work was directed to find out what effect differing emissivity from areas of the shaft surface might have; the conclusion was that this cause could be ruled out. The second attack was to assume that the co-efficient of expansion of the shaft (a carbon-molybdenum hollow forging) varied from one side to the other and to calculate this variation from the known shaft deflection. This indicated that to produce the bending effect a variation of between 2 and 4% in coefficient of expansion between the opposite sides of the shaft was necessary.

Specimens were then removed from one of the two shafts concerned and the coefficients of expansion of them checked. It was found that there did, in fact, exist a coefficient of expansion variation of sufficient magnitude to cause the observed deflection. The reason for this difference remained to be found. By heating two test specimens in evacuated silica tubes and renormalising by heating at 910° C for 1 hour, furnace cooling (185° C per hour at 700° C) and tempering for 2 hours at 675° C, it was discovered that the coefficients of expansion of the two specimens became identical. One specimen was then transformed to pearlite by austenitising at 850° C for 1 hour, furnace cooling to 650° C (185° C per hour at 700° C) and holding for 80 hours at 650° C, followed by furnace cooling to room temperature with a 2 hour temper, at 675° C. The other specimen was transformed to give 10% ferrite, and the rest bainite by austenitising at 925° C for 1 hour and furnace cooling to room temperature (400° C per hour at 700° C) followed by 2 hours at 675° C. These treatments restored the differential in coefficient of expansion. Further experiments confirmed the effect.

It was, therefore, decided to renormalise a second shaft which had exhibited bending under temperature. To ensure temperature uniformity in the austenitising treatment (8 hours at 935° C) the shaft was slowly rotated in the furnace at 8 revs/hr, and air cooled. Retesting showed that the deflection had vanished.

The experimental methods adopted to treat the specimens were so different that it was felt that further experiments should be undertaken approximating more closely to works practice. These tended to confirm the results arising from the laboratory tests. In the conclusion, it is pointed out that in all cases where the expansion coefficient difference has been observed, the high-expansion-coefficient material has a carbide with the structure of Fe_3C and the low-expansion-coefficient material has a carbide with the structure $M_{23}C_6$ where M represents the metal atom, in this case about 22 atoms of iron and one of molybdenum.



Induction Heating for Steel Ingots

NEW APPLICATION SPEEDS ROLLING MILL OUTPUT

CLAIMED to be the first steel-ingot induction-heating installation in the world, a new furnace at the Vancouver Rolling Mills of Western Canada Steel Ltd. re-heats ingots in 8 to 12 minutes compared with the 45 minutes needed in an oil-fired furnace. Overall, the new installation is stated to increase production by 30% and reduce fuel costs by one dollar a ton. In addition to direct advantages from speedier heating, costs are reduced because less scale is formed.

Ingots are continuously pushed through the two tunnels provided in the furnace.

Fork-lift trucks bring ingots from stock piles to tables which spread them out and feed them to conveyor belts. Hydraulic rams push each ingot into the furnace and in so doing, push another ingot out the other end. A power-driven roller conveyor carries hot ingots from the furnace to the rolling mill.

To give the greatest practicable efficiency of operation, approximately half the electrical power for heating is delivered to the furnace at 60 c/s (standard frequency in North America). The balance, taken at 540 c/s, is used for the final heating of the ingot, after it has been brought to a high temperature.

Power Supply

Power supply for the whole mill is taken at 60 kV, and is stepped down to 4 kV in three 3 MVA transformers, and to 550 V in a further 4 MVA transformer used for supplying the first part of the furnace. This latter transformer is connected in star and six circuit-breakers are installed controlling two groups of induction coils in each phase. Return cables from each coil are solidly connected to earth electrodes, as is the transformer star point. Effective earthing for this purpose is provided by 16 eight-foot rods spaced mutually eight feet apart, which gives 0·5 ohm resistance to earth.

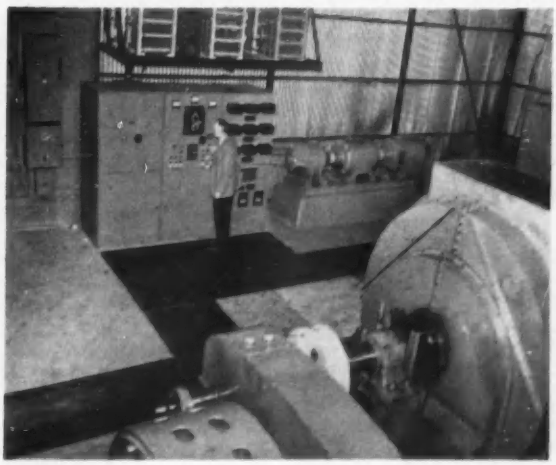
The 540 c/s supply is obtained from a motor-generator, driven by a 5,700 h.p. synchronous motor, operated at leading p.f. to balance the works load. An auxiliary slip-ring induction motor is used for running the m.g. set up to speed, this auxiliary motor being disconnected by an air-operated clutch after synchronisation. Nominally the 540 c/s output is at 400 V, but a motor-operated field rheostat is provided for adjusting this. Current is taken to the heating coils by a large number of individual cables with phasing interleaved. These cables are supported by wooden clamps and run in an aluminium race-way. Once more, the generator is star-connected, and both the star point and the return from each lead is connected to earth.

No switching is carried out on the 540 c/s installation. Over-current relays and balanced-split phase protection of the generator windings are provided, and these are arranged to operate a contactor-type field-discharge switch controlling the alternator excitation.

Power-factor correction is, of course, applied to affect coil reactance to some extent. Because of the variation with temperature of the magnetic properties of steel, the amount of correction required varies with the coil groups along the furnace. Adjustments have been made on a basis of operating experience, and the result is an average power factor better than 0·9, approaching unity under most operating conditions. Capacitors used on the 540 c/s side are water-cooled, the water being supplied from the circuit described below.

Coils of the furnace are insulated with glass tape and silicon varnish, and cast in a castable refractory of high

Top of the page is a view of the twin tube induction heating furnace. Ingots leaving this have a temperature of 2,270° F. Below is the machine room for 540 c/s generator. The motor generator is seen right, and relay board and exciter, left



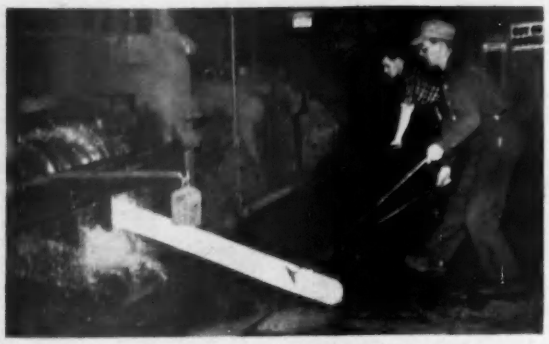
density and strength, which prevents vibration of the coil breaking down its insulation. Originally stainless steel liners (310 in all) were provided, but these were subjected to severe vibration, and in consequence broke down the insulation between themselves and the coils. A solution has been found in the use of high silicon ceramic liners, the liner being bonded to the coil and held steady by the castable refractory.

Operation

Input power for the furnace has been established at 300 kWh/ton for the largest billets, including all losses. Output ranges from 15 tons/hour for 4 in. x 4 in. x 36 in. billets, each of which takes 3·6 minutes to heat, up to 20 tons/hour for 5¼ in. x 6¼ in. x 49 in. billets each of which takes 8·4 minutes to heat. Ingots leave the tunnel at a temperature of about 2,270° F.

Cooling water for the various components of the furnace is obtained from a closed circuit incorporating a small cooling tower. Flow is 415 gallons/minute at 60° F.

After the ingots have left the furnace they go to a 16 in. mill which is driven by a 1,000 h.p. motor, and then to a 12 in. mill which is driven by a 700 h.p. motor.



Ingots leaving the 16 in. mill after first rolling operation

Principally concerned in the design and installation of the new furnace were, besides the engineering staff of Western Canada Steel Ltd., Canadian General Electric Co. (alternator) and Electric Power Equipment Ltd., Vancouver.

READERS' VIEWS

Correspondents writing under a pseudonym are asked to submit their names in confidence to the Editor

Fluorescent Lighting in the Home

WHILST applauding for the most part, Mr Stickley's discussion of many of the factors involved in introducing fluorescent lighting to the average small home, I cannot imagine that, even with credit buying, his arguments overcoming the technical difficulties of fluorescent lighting will carry much weight when it comes to persuading the average householder to consider its use for social purposes. Most people in the trade will agree that fluorescent fittings present few difficulties in their installation, that radio interference is not a serious problem, and that hum can be kept below an objectionable level. But even then can the industry expect to sell fluorescent lighting to the average user for social use if, compared with filament lamp installations, fittings continue to be the technical complexity of chokes capacitors and the like enclosed in housings of frightening proportions? I hasten to add here that size is no longer a major objection to utility lighting—in kitchen, bathroom and the like—for which the modern batten fitting, in its 2 ft and 4 ft sizes, is now ideally suitable. When, to these considerations, are added the further complexities of hire purchase (even though this method may remove the objection to high initial cost) the procedure of purchasing and using fluorescent fittings becomes far removed from the simplicity of buying tungsten lighting fittings.

Particularly for social lighting, therefore, the fluorescent unit has still some way to go before it can compete with tungsten lighting on the grounds of simplicity, although the ballast lamp has made a considerable contribution in this respect. But whether the choice is to be ballast lamp circuits or not, fluorescent fittings will still have to be much simpler than at present, utilising the minimum of fixing devices and employing a light, easily removable plastic shade rather than the complex (and costly) arrangements of "egg box" louvres or reeded "Perspex" at present in fashion. This may not be the ideal in lighting practice, but as much as I support the aim of introducing good lighting to the home I cannot envisage the average householder being prepared to assimilate the details of lighting practice or to be re-educated into thinking of lighting as a specialist installation, very much as a cooker or immersion heater. If the industry is really concerned with selling fluorescent lighting to the domestic market, it will only succeed when it can offer simple fluorescent units, capable of easy installation and purchase, which will, at least, ensure that the householder will have more light for seeing.

"Fluorescent Enthusiast,"
LONDON, S.W.

* * *

MR STICKLEY in his article on fluorescent lighting for domestic premises does not emphasise fully some effects of colour rendering. Fluorescent lamps have effectively a discontinuous spectrum, and much energy is still emitted in the near u.v. bands. This causes fluorescence of external materials which can be most distasteful. One has only to see the protein fluoresce in a naturally fermented beer viewed under fluorescent lighting to appreciate this phenomena. The same must apply to many foodstuffs used by the housewife.

C. Oppenheimer,
LONDON, W.C.1.

Outdoor Insulators

MR GILLAM'S letter commenting on my article on outdoor insulators is a welcome and expected comment upon it. He refers to the "art" of designing insulators and thereby indicates a difference in our respective approaches to design problems. However, he agrees with all the essential points of the article and also that there is more work to be done before the ideal laboratory pollution test can be specified.

Mr Gillam apparently agrees that better insulators can be designed if specifications are revised on a realistic basis. That being so I hope that he, and your other interested readers, will press for the appropriate revisions to the specifications involved.

H. H. Begent,
HADLEY WOOD, HERTS.

Electric Controls for Central Heating

By E. R. Hickmott

OUTSIDE TEMPERATURES AFFECT HEATING REQUIREMENTS

THE low efficiency of the open fire and the rising cost of fuel has focused attention on central heating for all types of domestic premises. This interest has been further emphasised by the Beaver Report on air pollution and the gradual change in public opinion on the psychological necessity to sit before an open fire. Many of the complaints made in the past regarding central heating were due to faulty design and operation. The comparatively narrow band of comfort conditions is almost impossible to achieve by manual control and it is the better appreciation of automatic controls which has brought central heating within the economic reach of a growing number of satisfied users.

At first sight the problem of controlling a hot water radiator system would appear to be merely a question of providing room thermostats and fitting motorised valves in the radiator feed pipes. Although this arrangement might be satisfactory in the case of one or two isolated radiators it has a number of disadvantages. In the first place a number of thermostats would be required throughout the building. Secondly, with a constant boiler temperature severe hunting of the motorised valves might occur during mild weather and, in fact, there might ultimately result a partial loss of control, particularly where simple on/off control was used.

The Inside/Outside Compensator

In order to overcome the problems already mentioned a number of manufacturers produce electrically operated control equipment in units generally known as inside/outside controllers or compensators. The function of the apparatus is to relate the heat output of the central heating system to the heat losses from the building. It will be obvious that the insulating properties of a structure are a constant factor while the main variables are the outside temperature, wind and rain, etc. If, therefore, it is possible to relate the temperature of the hot water flowing in the heating circuit to these outside conditions a close temperature control would be maintained within the building. There are a number of methods by which this relationship can be established ranging from purely mechanical equipment to electronic devices.

One well established electrical method consists of an outside controller or pilot which adjusts a rheostat in accordance with conditions. This is achieved by a heat-sensitive bellows unit contained in a weatherproof case which is slightly heated so that evaporation and other conditions result in a loss of heat. In other words, the rheostat is positioned as a function of the external variables. The rheostat is electrically connected to a special thermostat situated in the main radiator flow pipe and controls the water temperature either by switching on or off the boiler controls or by positioning a motorised three-way mixing valve which admits more or less cool return water into the main flow. The special thermostat or regulator is similar to a standard instrument, but has in addition a heater coil which alters the operating point. The heater is energised with low voltage a.c. and the degree of heating is determined by the outside unit through the positioning of the rheostat. Fig. 1 shows the schematic layout of the electrical circuit for the simple on/off arrangement.

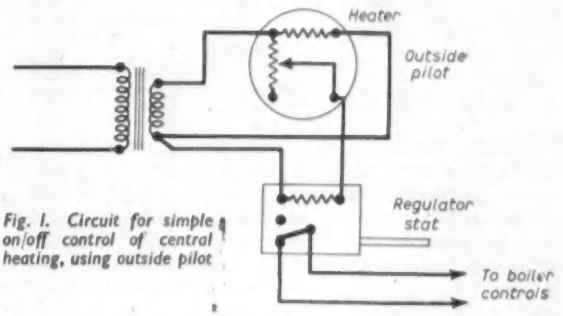


Fig. 1. Circuit for simple on/off control of central heating, using outside pilot

The control of a mixing valve requires a similar outside unit but the regulator is of the modulating type having a thermostatic switch with a mid-off position. The schematic circuit is shown in Fig. 2. It will be noted that timer contacts are included in the circuit and these have the function of providing control of the response rate between the regulator and the motorised valve. In the practical arrangement the time period when both contacts are closed can be adjusted so that the rate of control can be matched to the characteristics of the heating system and the building. Another feature of interest is the top bridging contact of the regulator which has the effect of shorting out one time contact and so speeding up the response. This contact is not made unless there is a larger than normal fall or rise in temperature when the contact arm of the regulator moves further and so makes the additional contact. An instance where this comes into play is on starting up from cold, when obviously the valve should move to the full heat position as quickly as possible.

Provision is also made in the practical set-up for reducing the flow temperature at night and increasing the temperature for boosting purposes when it is required to bring the building up to control temperature as quickly as possible. These effects can either be manually operated or the switching carried out by a time switch.

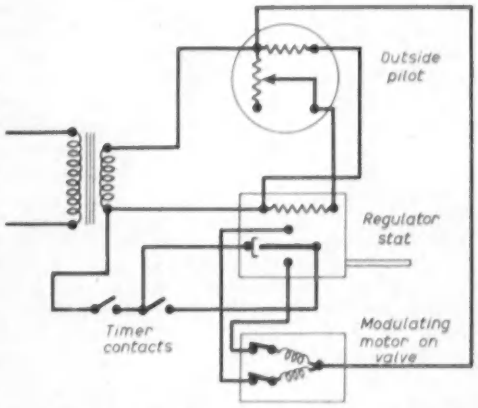


Fig. 2. Circuit for control of mixing valve incorporating outside pilot

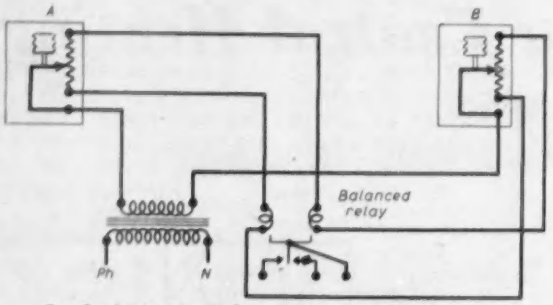


Fig. 3. Bridge circuit for providing inside/outside control

Another method of providing inside/outside control is based upon the Wheatstone bridge circuit. Two potentiometric temperature controllers are used together with a balanced relay. The general arrangement is shown in Fig. 3. One controller A constitutes the outside unit while the other controller B senses the flow temperature. The temperature change required to effect a full movement of the controller A might be 30° F (say a range between 30° F and 60° F). Controller B might have a full movement of 60° F (say a range between 120° F and 180° F). Thus in order to balance the bridge circuit for every one degree change in the outside temperature the flow temperature would have to rise or fall by 2° F. The balance relay can be used for simple on/off control, or to position a reversing motor unit for proportional control. It will be observed that a rise in outside temperature results in a fall in the radiator flow temperature. In practice, of course, the equipment is provided with adjustments so that the ratio between inside and outside temperatures can be modified to suit individual conditions.

Electronic control systems are based upon a similar circuit in which the potentiometric controllers are replaced by resistance elements. The change of resistance in the outside unit is measured against the resistance of the regulator unit and the resulting out-of-balance current triggers an electronic amplifier which in turn energises the relays effecting the switching operations. The resistance elements can be standard wire wound units or "Thermistors," both types of equipment now being available in this country.

Additional Controls

Reference has already been made to the use of a time switch for automatically reducing the temperature at night. In some cases where there is adequate gravity circulation the time switch can also shut the accelerator pump off at night, and, where hot water is supplied by the same boiler, the primary and secondary circuits of the calorifier can also be shut down. In offices and similar premises where no heat is required at night the time switch can be arranged to effect a complete shut down. It is normal procedure, however, to provide a standard room thermostat connected in parallel with the time switch to bring the system back into operation if the internal temperature falls below a certain level.

Although compensators proportion the heat output to the heat requirements so that, as in the above example, the flow temperature would be reduced to 120° F when the outside temperature reached 60° F, it is obvious that heat will still be required to maintain even this minimum temperature. In order to avoid this unnecessary heating, a further thermostat is sometimes fitted adjacent to the pilot, set at say 62° F and arranged to completely shut down the heating plant. Fig. 4 shows the schematic circuit for a normal domestic central heating system.

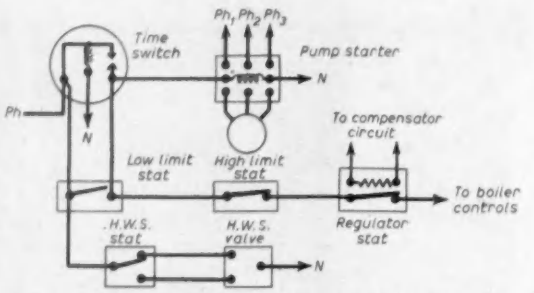


Fig. 4. Electrical control for domestic central heating system

It will be noted that the directly operating compensator varies the output temperature of the boiler and it is, therefore, not suitable for use where the hot water supply is derived from the same boiler. Where a mixing valve arrangement is used the boiler controls are set to give a constant output temperature usually about 180° F. This temperature is too high for the domestic hot water supply and a further thermostat in the secondary of the "indirect" cylinder is connected to a motorised valve in the primary return to limit the hot water temperature to about 150° F. This additional circuit is also shown in Fig. 4.

Conclusions

Efficiencies of about 75% are possible with a fully controlled central heating system and this fact seems likely to encourage more general use. Although the initial cost of automatic control equipment is a comparatively large item for the smaller heating system, the saving in fuel is sufficient to make the additional capital a sound investment.

C.E.A. Apprentices at work

AT the start of their training, apprentices in the C.E.A. London Division spend eight months at a training centre which provides them with a grounding in engineering and the use of tools. For those whose craft is to be mechanical maintenance, the school is located at Bankside power station, where an open day was held last week.

After an initial period in the fitting shops, students pass to the machining department where they learn to operate lathes, millers, grinders and other machines. A parallel course teaches forging, smithying and welding. Using their new skills, the students produce a range of tools which become their property eventually. At the end of the course prizes are presented to the best all-round student, the best practical worker and for the best example of practical work. On this occasion the prizewinners were Ian Speake, Alan Joy and George Clayton, respectively. Mrs J. Eccles made the presentation.

One of the many activities in the training centre is gas welding, seen here being demonstrated by one of the students

From an engineer's notebook

THE tremendous expansion in quartz crystal manufacture to meet the demand for frequency-controlled wireless sets during the last war was left high and dry when hostilities ceased. At that time I consequently anticipated considerable development in the field of ultrasonics as a result of an effort to turn available manufacturers' resources to the making of quartz ultrasonic generators. Unfortunately, the efforts of research departments to this end have not been marked with success. It seems to me that ultrasonics is one of those subjects that is always just round the corner. Promising experimental results have been reported for a whole variety of applications ranging from the killing of bugs to performing the weekly wash. Rarely, however, does one come across ultrasonics in practical everyday use. The ultrasonic drill has reached commercial production and soldering techniques using this method have been applied to the tinning of aluminium. More recently it has been suggested that in the quenching of intricate metal shapes, more uniform hardening can be achieved when high frequency vibrations are used to break up the boundary layer of vapour. However, I feel the palm must go to the suggested use of ultrasonics to prevent the formation of barnacles on ships. It would seem that this crustacean is allergic to vibration (although to judge from some of the ships I have known, it must certainly be of the v.h.f. type) and experiments appear to be going ahead with the application of ultrasonic vibration to the whole hull. So, with the continuing input of new ultrasonic ideas the prospect for this fascinating field remains much about the same level of interest; this cannot be said of the possible market for quartz crystals, for magneto-striction now offers a formidable rival as a means of generating h.f. sound waves.

* * *

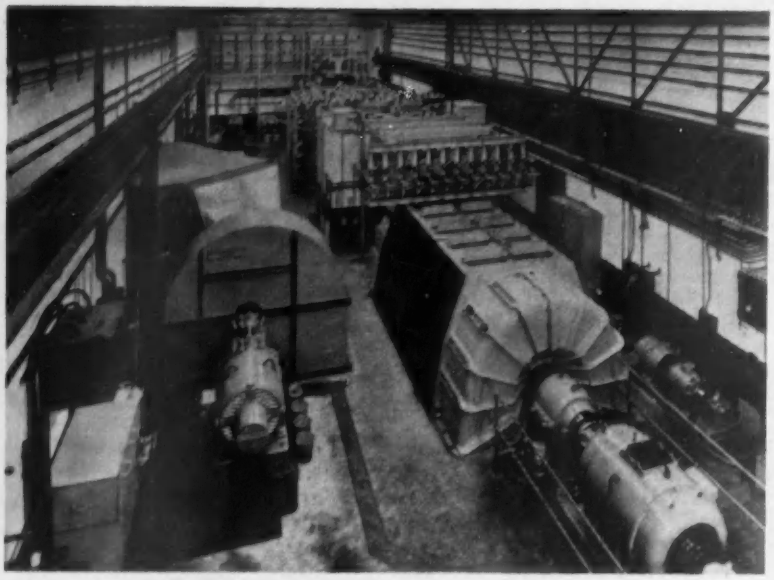
IN a more restricted field, much the same combination of high promise with restricted achievement may be said of heat storage by chemicals. Basically the idea of a crystalline salt that will store heat when passing to the liquid state, to be given off later when recrystallising, has all the appeal of convenience and simplicity. In practice, it has been studied for use with solar systems and experiments carried out in connection with heat pump systems, with but little achievement. The E.R.A. has been investigating the idea for some years but appear to be less active in this field now. Recently, however, this method of heat storage has been suggested for the mundane field of packaging. In this case sodium sulphate has been used to protect packaged materials against too low or too high a temperature. The salt is sealed in cans which can be placed in the pack, the cans being preheated or cooled, depending on whether low or high temperatures will be experienced. The phase transition temperatures are 37° F and 90° F and these temperatures will not be exceeded while adequate quantities of the salt are available within the pack. The heat storage capacity, however, is limited to 104 B.Th.U. per lb of crystals, but combined with adequate thermal insulation this may be sufficient in the limited field of packaging to which this idea can have application.

* * *

I CAME across recently one of those simple and delightful discoveries that any one of us might have found had we the right measure of observation and curiosity. We have all at some time played with spiral springs and perhaps when repairing the family alarm clock pulled out the spring at right angles to the spiral. Such a spring has been aptly termed a serpent spring and has been shown to have peculiar properties. When increasing weights are applied to the free extended end of such a spring, the length continues to increase until a critical zone is reached when for an equal increment in weight the increase in extension is considerable and the twist of this free end likewise increases. Thus by operating a serpent spring in its critical zone a highly sensitive spring is obtained. It is stated that changes in the acting force of one hundred-thousandth can be detected by a twist of 0·2° of the end. It would seem that the full potentialities of this spring have yet to be ascertained. No doubt the possibilities will appeal to those concerned with instruments although the shape of the spring hardly matches the current trend towards miniaturisation.

* * *

WHEN first I heard of the germanium tetrode two years ago, I imagined the transition had started on the road towards those complicated electrode arrangements we find in valves. Now that further information is available I find I am wrong and the second input electrode is no more than a method of overcoming the limited frequency response of transistors. In America, work appears largely concentrated on the n.p.n. junction transistor and the major line of attack towards reducing the response time and thus improving the h.f. performance is by reducing the thickness of the p layer as well as by restricting its diameter by adopting a dumbell shape. I have already referred to this approach but with the reduction of the layer to thicknesses of the order of 2×10^{-4} in., a new difficulty has been encountered, for it is found that an internal feedback is introduced from the output to the input circuit which nullifies the improved diffusion of electrons across the p layer. It was for the purpose of restricting this feedback that the fourth electrode was added, connected diametrically opposite to the input and given a few volts bias. This bias causes the signal current to flow in a constricted path to one side of the transistor and in some manner, unexplained in detail, this reduces the feedback. Although commercial applications of the transistor are confined at present to audio frequencies, it is becoming clear that extension to the h.f. range is well within the possibilities of semi-conductors under the intense pressure of modern research.—*E.R.G.*



DEVELOPMENT OF PLANT AT WITTON WORKS OF THE GENERAL ELECTRIC CO. LTD.

20 years of switchgear testing

IN 1934 the high-power testing laboratory of the General Electric Co. at Witton was put into operation. This was originally designed to deal with circuit-breakers rated up to 1,500 MVA at 132 kV; the maximum size being used in this country at the time. It was nevertheless realised that both voltages and ratings would increase, and space was allowed for future extensions.

The original installation consisted of one specially-designed 3-phase alternator running at 3,000 r.p.m., each phase having two windings which could be connected in series or parallel, while the stator could be connected in star or delta. This gave alternator output voltages of 6·6, 11, 13 and 22 kV at full field current, with intermediate voltages available from field regulation.

To obtain full recovery voltage, a separate large exciter was installed, driven by a 1,500 h.p. motor and provided with a 13-ton flywheel. This machine can give 1,200 V d.c., and when connected directly to the alternator field, enables the current to be increased to seven times normal. This permits the drop in recovery voltage to be eliminated up to moderate outputs and much reduced at higher values.

The measured symmetrical initial output of the machine was over 2,000 MVA at voltages up to 22 kV. For higher voltage testing, three single-phase transformers were installed, and 3-phase testing voltages of 19, 33, 38 and 66 kV could be obtained, and by rearrangement voltages of 57, 76, 95 and 114 kV. Single-phase tests could be made on 132 kV systems up to values equivalent to that of the first phase to clear on a fault, namely 86% of the rated line-line voltage. Other equipment included reactors and resistors, a special air-insulated closing switch, a G.E.C. 12-element electro-magnetic oscillograph, a cathode-ray oscillograph with film running at 20,000 ft/min. max. within the vacuum, and a step-down transformer for heavy current testing.

By suitable modifications, the making-switch was made suitable for operation with an overall consistency of ±10 electrical degrees, permitting a choice of point on the voltage wave for closing on the test circuit. These modifications were carried out in 1940.

For testing air-blast breakers, it was necessary to take into consideration the restriking voltage characteristics of the circuit, and a restriking voltage indicator was obtained, which enabled a rapid survey of the circuit to be made without the requirement of energising the circuit or applying a short-circuit. In 1937, the c.r.o. equipment was extended by adding a 3-phase unit, and later the original single-phase unit was modified to use four sealed glass

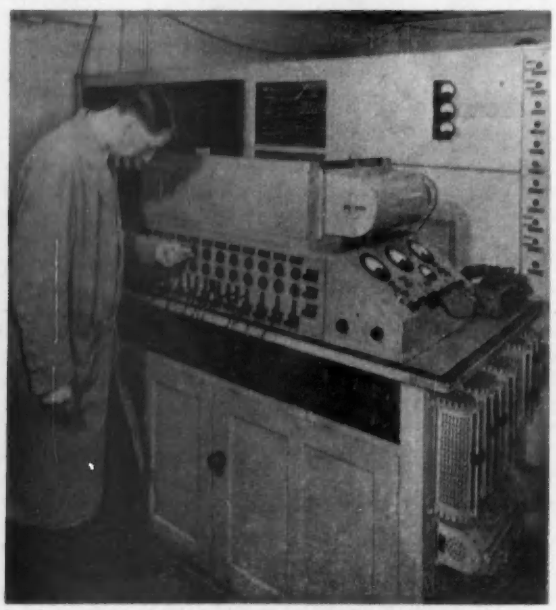


Fig. 1, top, shows No. 1 machine room with the 2,000 MVA alternator on the right. Fig. 2 above shows a 12-element electro-magnetic oscillograph in the control room

cathode ray tubes. A high-speed camera capable of taking 3,500 frames per second was also obtained in order that the performance of high speed mechanisms or of switch breakdown on test could be studied. Facilities were also provided for developing and projecting these films.

After the war it became clear that system short-circuit capacities and system voltages would increase rapidly and that the original plant would become inadequate. Various indirect or synthetic testing circuits were considered, whereby the short-circuit current could be applied from the existing plant and the restriking voltage applied separately at a higher value from either new transformers or from impulse voltage circuits. None of the schemes, however, was judged to offer reliable proof of rating for all types of circuit-breakers and it was decided to increase the output by additional alternator and transformer capacity.

As the original alternator had given good service with only minor troubles, and as for parallel running under short-circuit conditions it was desirable to have identical designs, it was decided to make the second machine to the same design as the first except for small improvements.

The increased output was mainly required for tests at voltages above 22 kV when it would be necessary to use step-up transformers. With the consequent additional reactance, the output per machine would be about 900 MVA 3-phase. It was also decided to use boosted excitation for this new machine, which required a second exciter of the same design as the first.

Running in Parallel

The procedure for running the two machines in parallel is simple. The two master circuit-breakers are closed with either the making switch or the test circuit-breaker open (depending upon whether a break or make-break test is to be carried out), with the alternators running at full speed, but without excitation. The stators can be connected in parallel either directly or via reactors in series with each machine. The two d.c. high-speed circuit-breakers are then closed, putting the two exciters into parallel and on to the two alternator fields in parallel, through the ballast resistance. When the exciter field contactor is closed, and the field current increased by the single field regulator, the exciter voltages rise together. The characteristics of the two exciters have been carefully matched so that there is neglible circulating current and the total excitation current is shared equally. As the alternator voltages rise, the two alternators automatically pull into step. As the alternator field ampere-turns are also balanced, the circulating current between stators is also a minimum. A few cycles prior to the application of the short-circuit, the alternator fields are boosted by closing (by the automatic timing controller) the boost contactor, which cuts out the ballast resistance in the alternator fields. The two alternators then share the short-circuit current equally, slowing down and holding in step. After clearance of the short-circuit, the field contactors, master circuit-breakers, boost contactor and the high-speed d.c. circuit-breakers are opened. This simple method has worked satisfactorily and enables a single engineer to operate the two exciters and the alternators throughout the testing, including bringing the four machines up to speed in the three-minute intervals of duty cycles.

The addition of this extra plant, together with new transformers and reactors, has permitted three-phase testing to be carried out up to 132 kV, 1,750 MVA 3-phase or

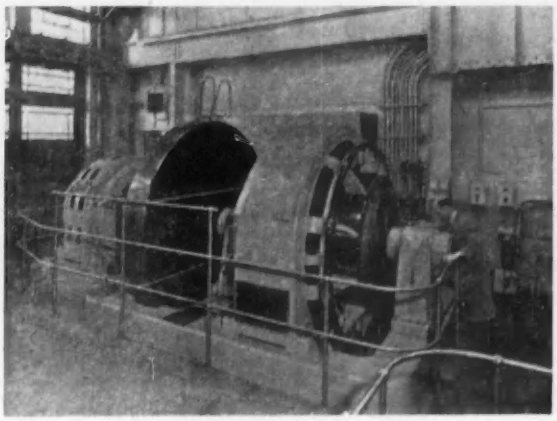


Fig. 3. The exciter set in No. 2 machine room. Driving motor:- 1,500 h.p. Weight of flywheel:- 13 tons

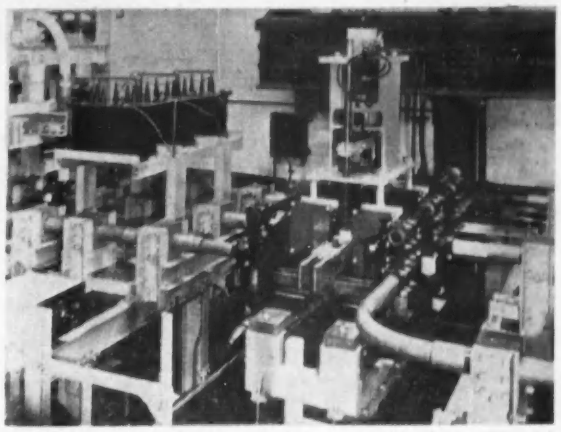


Fig. 4. Short-circuit closing switch open (contact enclosures removed)

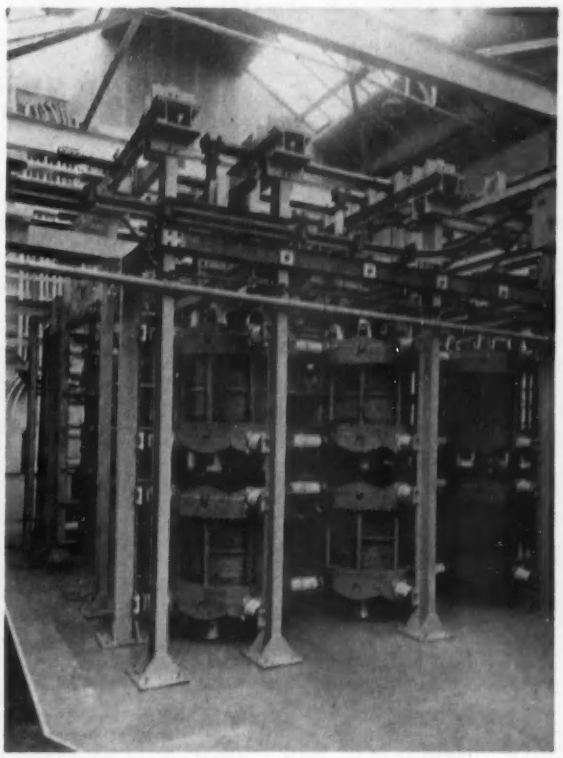


Fig. 5. 3-phase bank of air-cooled reactors, which provides a wide range of reactances for test purposes

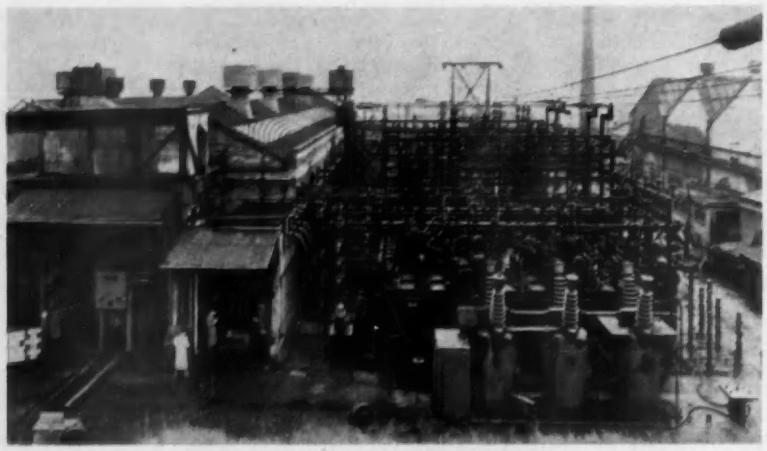


Fig. 6. General view of transformers and test area

152 kV 1,100 MVA single phase. Where multiple breaks are used, and unit tests can be made in accordance with A.S.T.A. publication No. 15, testing can be carried out to the equivalent of 15,000 MVA at 275 kV for 6 breaks per phase or 25,000 MVA at 330 kV for 8 breaks per phase. In most cases nearly 100% equivalent recovery voltage can be obtained using the value of the first phase to clear (1·5 kV/ $\sqrt{3}$) as the basis. In practice on systems of 132 kV and above, unearthed faults are rare and kV/ $\sqrt{3}$ nearer to practical conditions, and except for the highest rating of 330 kV, 25,000 MVA, 100% of this value can be obtained. Greater output could be achieved by adding further transformers. Space on the site is available for these, and three larger units are being designed. They will incorporate increased insulation to earth so that, in addition to increased MVA output, higher test voltages will also be obtainable. To accommodate large outdoor circuit breakers on test a special area was provided in front of the bank of high voltage transformers as shown in Fig. 6.

As high voltage circuit-breakers sometimes have to operate at a leading power factor when switching out unloaded transmission lines, it is desirable to check their ability to do this without damage to themselves, or producing excessive overvoltages by restriking the arc. The most satisfactory test is to use an actual transmission line, and by arrangements with the C.E.A., a line can be used at week-ends. It can be energised from the laboratory generators and high voltage transformers through the test circuit-breaker which can be operated to switch the line in or out when its performance is recorded on the laboratory oscillographs.

E.D.A. Full Ahead

DURING 1954, the Electrical Development Association successfully used all channels of publicity to boost sales of electricity. The 35th annual report of the Association, published this week, tells something of the work involved in this sustained effort. Comments at the Association's annual luncheon will be reported next week.

Co-operation with the Press is one line of approach, and it is noted that enquiries from journalists for information about electrical matters reached a new high level. Amongst subjects, automatic cooking made a particular appeal to women journalists, with refrigeration and home freezing also well up the list. Away from the domestic field, an E.D.A. story which received exceptional attention was the accentuation of road lighting as a "Matter of Light or Death."

Electric cooking has secured a further boost through E.D.A. influence, because the demonstration kitchens established by some food product manufacturers have been equipped with the latest electrical equipment. Another sidelight on the wide range of activities that has to be borne in mind in E.D.A. planning occurs in the statement that close relations were maintained with the sound and television sections of the B.B.C. The result was to be found in the way electricity was kept well to the forefront in many regular features, including "The Archers" and "Mrs. Dale's Diary."

As well as such "free" publicity, the Association paid its usual close attention to advertising. It is estimated that the "Four Foundations of Modern Living" theme was presented in advertisements of which a total of 268 million impressions were made.

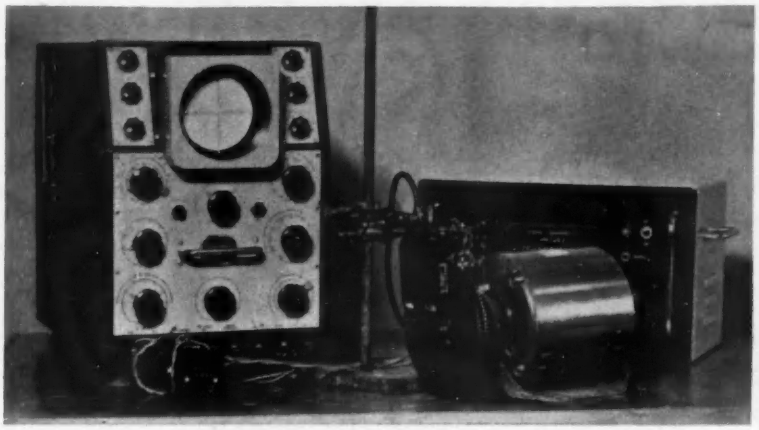
A number of courses were run in connection with rural electrification. They served both the farmer who wanted to know more about electricity, and the area board officer who needed more knowledge about electricity in farming. For those following a regular course of training in agriculture, the Association set up a scheme for the loan of models of electrical apparatus. Backing up all this work was activity at no less than ten agricultural, etc., shows.

A new committee, meeting for the first time during the year, is the Industrial Development Committee. Mr. L. Howles was the first chairman, and the terms of reference "To consider steps to be taken to foster and develop the use of electricity in industry and to make recommendations to the Council thereon." The staff of the Association extended its studies of industrial engineering, and was much in demand for advice.

The Electrical Appliances Committee of the Association had an active year, as usual. Matters considered included a survey of the adequacy of wiring installations in local authority housing, and the use of cartridge fuses in consumers' apparatus. Amongst matters discussed by subcommittees were the possibility of developing a low-cost water heater for use in reconditioned houses, and simplification of cooker design.

Test House Activity

Finally, in this necessarily brief account of E.D.A. activities in 1954, attention may be turned to one of the more technical undertakings of the Association. During the year, the testing house at Leatherhead handled an increased amount of work, and issued 172 reports on new apparatus and investigations and 43 addenda concerned with revised appliances. Altogether, 230 appliances and special problems were concerned in this work, 37 of the investigations being made for the joint advisory committee on electrical appliances and accessories and seven for the Canadian Standards Association Approval Agency. The great difficulty which affected the testing house during the year was staff recruitment.



By E. C. CARLICK, GRAD. I.E.E.

Instantaneous speed determination

AN ELECTRONIC ATTACK ON THE OPENING SPEED OF CENTRIFUGAL SWITCHES ON SMALL MOTORS

IN order to obtain the best possible starting performance from single-phase fractional h.p. induction motors, it is necessary to ensure that their associated centrifugally-operated switches will open within close limits of predetermined operating speeds.

In investigatory work on the switches, therefore, an accurate method is required for measuring the motor speed at which a switch opens, particularly when the motor is accelerating rapidly. One method for checking the centrifugal mechanism is to rotate it with a variable speed motor, the opening speed being measured with a tachometer, but this method has the obvious disadvantage of being suitable only for very low accelerations. An improvement on the method is effected by the use of a tachogenerator, this being coupled to the test motor shaft and its output displayed on one trace of a double-beam oscilloscope. The second beam is used to indicate when the switch opens. However, difficulty is experienced with this second method in that modulation or ripple on the output voltage of the tachogenerator prevents accurate measurement of the oscillograms. Similar difficulties also occur when a tacho-alternator is employed. It may be possible to obtain a modulation-free voltage which is proportional to speed when a homopolar type of machine is used, but in this case, in order to obtain sufficient voltage it would be necessary for the machine's physical dimensions to be such that its inertia would adversely affect the acceleration of the test motor and thus limit the usefulness of the method, particularly with small motors where the inertia of the rotating parts is small.

The alternative to a voltage/speed method of measuring the motor speed at which a centrifugally-operated switch would open is some method based on a frequency/speed principle. Experiments have been carried out at the Development and Research Department of Crompton Parkinson Ltd. using this latter principle, and a procedure has been evolved which has proved successful.

Fig. 1 (at top of the page). Equipment for speed checking:—Left to right, oscilloscope, motor-driven disc with photo electric cell assembly, and, in background, audio frequency oscillator

Principle of Test

The principle of the test is to arrange for the motor to generate a signal, the frequency of which is proportional to the instantaneous speed of the motor. The signal is recorded at the instant of switch opening and the frequency compared with that of a standard frequency oscillator.

Under light load conditions, a single-phase, 4-pole fractional h.p. induction motor may accelerate to full speed in approximately 100 millisecs. Generally, it would take longer than this to reach full speed under load, although under some conditions, say with a capacitor start motor, it could be less. As a first assumption, however, it was considered that it would be sufficient if the method could enable the opening speed of the switch to be determined with the motor accelerating such that it would attain full speed in 100 millisecs. The acceleration would thus be of the order of 15 r.p.m./millisec. (1,500 r.p.m./100 millisecs.) assuming uniform acceleration and that the switch would open at approximately 1,200 r.p.m. (This speed varies, of course, with the design of the machine.)

In order to obtain a signal, such that the frequency of

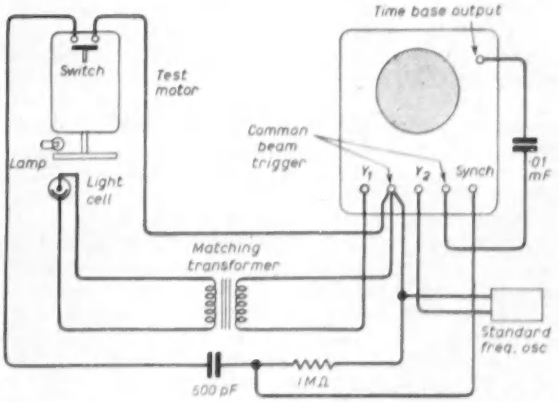


Fig. 2. Circuit adopted for triggering oscilloscope

adjacent cycles would not vary by more than, say, 1% at an acceleration of 15 r.p.m./millisec., the motor has to develop a frequency of at least 1,250 c/s at 1,200 r.p.m.

Method of Obtaining H.F. Signal

As the signal frequency must be greater than 1,250 c/s at a motor speed of 1,200 r.p.m., one complete revolution of the motor must generate at least 62·5 cycles.

To obtain this, a steel disc, ¼ in. thick and of 6 in. diameter, is fitted to the shaft extension of the test motor. The disc has 100 radial slots milled on the periphery to a depth of ½ in., so that teeth and slots are formed with transverse dimensions of approximately ¼ in. and 1/16 in. respectively.

A light source and a photo-electric cell are then arranged so that the slotted disc interrupts the light entering the cell; thus, the output from the cell is modulated at the frequency at which the teeth interrupt the light beam, i.e. 100 cycles per revolution. The output from the cell is recorded as a signal on a cathode ray oscilloscope. A photograph of the equipment is shown in Fig. 1.

Recording and Calibrating Signal

The output from the photo-electric cell in the tests was connected to the amplifiers of a Cossor Model 1049 double-beam oscilloscope. By using the circuit shown in Fig. 2 it was possible to arrange for the time base to be triggered as the motor switch opened, thus obtaining one trace of three cycles at the instant of switch opening. At the same time the beam—normally at reduced brilliance—was brightened. This technique prevented fogging of the film on which the trace was recorded. A calibrating trace was derived from a frequency standard oscillator of 10 kc/s connected to the second beam of the oscilloscope.

The main difficulty encountered in calibrating the trace accurately is in the measurement of the signal period. It is essential, in fact, to have the length of period on the trace as long as possible, and it is convenient to set the time base frequency of the oscilloscope for the display of about three complete cycles. A typical oscillogram is shown in Fig. 3.

The oscillogram was calibrated with a travelling microscope by measuring the period of one cycle of the unknown signal and five cycles of the calibrating frequency. The calibrating trace was measured over five cycles to increase the accuracy, and subsequently divided by five to obtain the period.

It can be seen that the velocity of the time base is the same for both unknown and the calibrating signals. If L_1 be the period of the unknown signal and L_2 the period of the calibrating signal, and if F_1 and F_2 be the frequencies of the unknown and calibrating signals respectively, then

$F_1L_1=F_2L_2$, therefore $F_1=F_2L_2/L_1$ c/s.

If R is the speed in r.p.m. when the switch opens and there are 100 cycles generated per revolution, then $F_1=100\ R/60$ c/s, and $R=60F_1/100$ r.p.m.

In this case $F_2=10^4$ c/s and therefore $R=6{,}000\ L_2/L_1$ r.p.m.

Accuracy of Method

The travelling microscope used detects differences of 0·02 mm, and as the measurements made were approximately 4 mm, the nominal accuracy of measurement of L_1 and L_2 was 0·5%, and of the ratio L_2/L_1, 1%.

The accuracy is somewhat decreased in practice as the trace on the film, when viewed through a microscope, is not clearly defined. However, repeat tests on a number of traces have shown that the variation of results was not more than 1·5%.

The accuracy of the standard frequency oscillator is within 50 parts in 1 million so that errors are negligible.

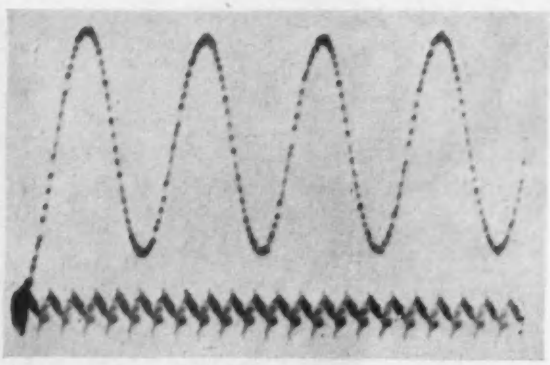


Fig. 3. A typical oscillogram

The accuracy of the toothed wheel is such that the maximum variation in frequency is 1½% total.

The overall accuracy of the method is therefore approximately 3% total or ±1½%.

In conclusion, therefore, it can be said that the method described is satisfactory for measuring the opening speed of centrifugally-operated switches to an accuracy of ±1·5% and it is therefore an extremely valuable tool for use on development work on fractional h.p. motors.

The method is also applicable, of course, to the measurement of an instantaneous speed of any rapidly accelerating rotating member, provided an electrical impulse can be obtained to trigger the time base at the required instant.

Electricity and the Brain

ELECTRICAL voltages generated within the brain and picked up by electrodes placed on the scalp provide one of the main methods by which the activity of the brain can be studied. The electrical instrumentation of this work and the direction in which it is developing, provided the subject for an enthralling lecture delivered to the I.E.E. Utilisation section last Thursday by Dr W. Grey Walter, a physiologist in the forefront of this work.

Dr Grey Walter said that the basic problem of the work is the fantastic complexity of the brain. It has about 10^9 individual cells, any one of which can communicate with any other. Every cell is a miniature battery, which can be charged and discharged to give a voltage of 1/10 V. However, such is the attenuation, due to flesh, scalp, etc., that the actual signals that have to be measured in investigation have values of a few tenths of a microvolt. The frequency components to be handled range effectively from d.c. up to 100 c/s, with a few higher components.

The design of suitable amplifiers for handling such signals is not particularly difficult now, but the brain cannot be studied by a single observation: the brain is an organ of change, and multiple observations have to be made over a period of time. A recording device is needed that will give a continuing record of signals from many parts of the brain. The present trend is strongly towards multiplication. 15 channels are becoming common, and 100 are envisaged. Eight channels is common in this country: eight is about the maximum number of channels the eye can handle.

With amplifiers relying on thermionic valves, such machines attain a formidable size. In this respect it seems that the development of the transistor is going to be of the greatest advantage to the brain physiologist. Indeed, in the long-term this may make possible the design of a literally pocket-size equipment which a subject will be able to carry around with him during normal activity.

Work of National Importance

ELECTRICAL RESEARCH ASSOCIATION 1954 ACTIVITY SURVEYED

TRIBUTES to the national importance of the work of the Electrical Research Association were paid last week by speakers at the Annual Dinner of the Association. Principal guest was Lord Woolton, and he welcomed particularly the fact that the Association was still having much of its work carried out extra-murally at universities. This was of advantage to society generally as well as to the Association because so much of value could come from the fundamental research in which the universities specialised. Although business people often worried whether it was worth while carrying on basic research, there was no doubt about the matter.

Great Britain had been criticised, perhaps justly, for the way it has concentrated on maintaining leadership in pure research and had not got on with the applied side. What was needed was to spend more money on research, so that both sides could have adequate attention. The nation had to recognise the importance of training technologists, who in turn would recognise the possibilities thrown up by fundamental research. Lord Woolton thought it was probably impossible to combine research and engineering in a university; some other sort of institution might be necessary for training the technologist.

Recruitment

Lord Chandos, President of the E.R.A., replied to the toast of "The Association," which Lord Woolton had proposed. He said that many of the troubles of modern man were due to his lack of realisation of his power to create wealth, which power was growing every day. There were few people who made such a contribution to this ability as the members of the electrical industry. A main worry in this connection concerned the supply of men for engineering work. If a sufficient number were not forthcoming, the country would fall behind in the race to remain a first-rate power.

Two industries were in the forefront of recent progress: the chemical and the electrical. Without the first it would not be possible to feed and clothe the population of the world: without all the electrical industry had done, it would hardly be possible to live in the world today.

The final speaker at the luncheon was Mr C. T. Melling Chairman of the E.R.A. Council. He said that all in the E.R.A. responded to the encouragement which was given by the willingness of eminent people to serve as presidents of the Association. This applied specially to the case of Lord Chandos. Referring to the part played by electrical firms in the export market, he commented that exports, like charity, began at home: at the basis were the research departments of the firms concerned. Much of the work of the E.R.A. had been applied by manufacturing industry in this country.

The Association received good support from member firms and from the D.S.I.R., both in financial terms and in facilities for engineers to serve on committees. But the present position was not fully satisfactory. It was necessary to go forward with vigour and vision and to seek a larger membership and perhaps larger contributions.

Continued progress in most branches of the Association's work is recorded in the 34th Annual Report, published last week, which covers the year ended 31st December last. In the field of administration and future planning the emphasis is on future financial arrangements, particularly in connection with the Leatherhead project. The plan is to move from Perivale to new laboratories at Leatherhead, Surrey, which is becoming something of a centre for research establishments. Building is well advanced, and occupation is planned for spring next year. New equipment is to be restricted effectively to a new h.v. laboratory. A number of researches will remain at Perivale, for the time being.

Insulation and Switchgear

The report reviews as usual activity in the various divisions of research. Only some of the more important investigations can be noted in this summary. A start may be made with the work on insulation and dielectrics, which continues to rank with switchgear as the largest group. Much of the work, particularly in the extra-mural field, is fundamental or theoretical in nature. Electrical properties of the newer synthetic insulants are being determined at the N.P.L.

Apart from such basic work, a large amount of standard testing of specific materials is required. Member firms help considerably in this, but it is now intended to increase facilities at Perivale for such work. Development of an improved method of determining the electric strength of insulating oils has reached the stage where a report is being submitted to the B.S.I. for consideration in any revision of B.S.148.

Advantageous features of a helical current path arc chute for air-break a.c. circuit-breakers have been patented during the year. Formulae have been derived for pressures set up in side-blast baffle-pot type o.c.b.'s and are being applied to commercial breakers. Basic work on arcing phenomena in circuit-breakers has improved understanding of conditions at current zero.

In the fusegear field an important research has concerned heating of multi-way fuseboards. Investigations have been started on the relative merits of strip and wire elements in fuse-links.

Wind Power and Rural Work

The general wind survey of sites in Great Britain and Ireland was completed during the year, and analysis and arrangement of the data obtained is proceeding. Work on the 100 kW generator in the Orkneys included the determination of performance data after modifications to the original design. At the Cranfield Windmill Research Station, three large and two small wind-power generators were in operation during the year. Commenting on the many requests received for advice on the purchase of plant, the report states "unfortunately, it is not yet possible to refer the enquirers to British manufacturers of wind-driven machines available commercially." A notable feature of the E.R.A. work on wind power has been its international prestige: Mr Golding, who leads the section concerned, has been in great demand for advisory duties overseas

Amongst the many interesting agricultural and horticultural researches in progress is one on killing small plants and weeds by electrical methods. Experiments on increasing yield by light irradiation have involved tomatoes, and flash illumination has been used to step up winter egg production by poultry.

Lines and Cables

Movements of cables in ducts have been under investigation, and a new and simple method has been evolved of calculating cyclic loading factors of specific cables. In connection with cables laid direct in the ground, concern is felt about some effects of increases of cable surface temperature, and a programme of field and laboratory investigations on moisture movement in soil under temperature gradient has been prepared. Work on the short-circuit strength of cables and joints has been brought to the report stage. In the field of smaller cables, an important step has been the conclusion of work on the current rating of house-wiring cables. Results have been communicated to the I.E.E. for use in the revision of the Wiring Regulations.

Development of a vibration recorder capable of running for long periods should advance an investigation to determine whether conductor sag in o.h. lines can be reduced without introducing vibration troubles. With regard to insulators, discussions continue on the possibility of establishing an artificial pollution test. Tests on the effects of sparking and corona on the corrosion resistance of galvanised steel spindles in insulators have so far given only negative results. Work on lightning surges on overhead lines continues to be largely concerned with the analysis of faults reported by area boards.

Transformers and Magnetic Materials

Much attention has been given to improving the technique of measurement in power transformer investigations. There has been work on temperature distribution in windings, on the causes of lateral vibration in relation to noise, on short-circuit forces, and on terminal oscillations of three-phase transformers due to switching under no-load conditions.

A study is being made of the effect of impurities in electrical sheet steel, with special reference to nitrogen. At University College, London, there has been an investigation into the iron losses occurring in a complete range of electrial sheet-steel laminations. Work on permanent magnets has included investigation of apparently irreversible changes in the magnetisation of Alcomax alloys when they are exposed to low temperatures. In addition, a large amount of fundamental work is being carried out by extra mural workers.

Installation and Application

During the year, drafting of material for a new Code of Practice on earthing was completed. Recommendations have been prepared as well in connection with the long-term performance of joints in aluminium and zinc-alloy and ferrous conduits and fittings. An analysis of fire risk associated with the fixed part of electrical installations, in relation to age of installation, is in progress.

Heat pump applications have received much publicity, and laboratory tests on the reliability of certain components are continuing. Wide investigations are being made into all aspects of floor-heating.

It was stated at the beginning of this summary, that a full picture of E.R.A. activities could not be given. Amongst items that can be no more than noted are the successful operation of hydrogen-oxygen cells for several hundreds of hours, developments in the protection of series capacitors and much important work on minimising communication interference. Results of all these activities, however, will eventually see the light of day in the technical reports which the Association publishes.

More Power for Belfast

LAST Friday saw the commissioning of the first section of Power Station West, the fourth of the stations erected by the Belfast Corporation in the past 60 years. This section comprises two 30 MW turbo-alternators and four 180 klb/hr boilers, and two further extensions are proposed. The first of these involves the erection of two 60 MW sets and seven 220 klb/hr boilers (steam conditions of 950 lb/sq in., 925° F) and the second extension will comprise two similar boilers and one further turbo-alternator, so giving an ultimate capacity of 240 MW.

The boiler units, supplied by Clarke Chapman and Co., are of the tri-drum type and use Melesco superheaters. Each superheater has a primary section and two secondaries. The furnaces are twin stoker-fired by Babcock and Wilcox-style twin stokers. Forced draught, induced draught and secondary air fans are provided (two of each per boiler) and each unit has fully automatic control. Steam conditions are 650 lb/sq in. 950° F.

The Parsons turbines are rated at 30 MW m.c.r. and 24 MW m.e.r. Each machine consists of two cylinders in tandem, and drives an alternator with m.c.r. of 30 MW at 0·8 p.f. The terminal voltage of each machine is 11·8 kV which is stepped up to 33 kV for system requirements. Main and pilot exciters comprise an integral unit, and a torsion bar drive is included to minimise the risk of vibration transmission from the main shaft.

The main switchgear consists of Reyrolle 1,500 MVA 33 kV small oil volume units. The electrical connections are taken through the wall of the switch house by specially-designed swivel bushings, which, by operating in conjunction with contacts carried on fixed posts on either side of the wall provide a convenient isolating method. Normally each circuit-breaker is operated from the control room although provision is made for standby local control. The busbars for the switchgear are bare copper rods and run along two floors of the building. Examination can be carried out from a central corridor which is isolated from the busbars themselves by expanding metal screens.

All coal supplies will be seaborne and a special jetty has been built by the Belfast Harbour Commissions to accommodate two modern colliers and four off-loading cranes. Two of these cranes are already installed and have a maximum handling capacity at the break of cargo of 150 tons per hr. Conveyors take the coal either to the stock area or to the boilers as required. Coal storage capacity is about 40,000 tons and off delivering from the stock yard is by transporter with an average capacity of 300 tons/hr. Ash is disposed by high pressure sluicing and is delivered by pumps to hoppers whence it is removed by road transport.

The formal commissioning of the station was performed by the Governor of Northern Ireland, Lord Wakehurst. The toast of the Belfast undertaking was proposed by Dame Dehra Parker, and the reply given by Councillor W. D. Geddis. Sir James Norritt proposed the toast of the "Government of Belfast," Mr Brian Maginess (Min. of Finance) replying. Sir Claude Gibb replied to the toast of the Contractors, proposed by the Deputy Lord Mayor, Alderman Andrew Scott.

Relays for Distance Protection

SIX UNITS MAKE UP NEW RANGE

COMPLETE three-step distance protection may require up to 18 ohmic measuring units if all types of fault are to be covered. For economy reasons, various compromise arrangements are usually introduced, with minor losses in simplicity or consistency. Such disadvantages are claimed to be reduced to a minimum in a simplified system of distance relaying recently introduced by the English Electric Co. Up to six types of relay units are used in five simple arrangements.

Two ohmic measuring units cover the distance relaying applications. A directional impedance mho unit is used for most underground cables and for overhead lines whose length exceeds 35 (kV/I) miles, where I is the minimum fault current. For shorter overhead lines, and for earth fault protection where ground resistance is high, a reactance unit is available. Based on these relays, the five arrangements possible are:

1. Mho relays for all faults.
2. Reactance relays for all faults.
3. Mho relays for phase faults and reactance relays for earth faults.
4. Mho relays for phase faults and inverse-time relays for earth faults.
5. Reactance relays for phase faults and inverse-time relays for earth faults.

Schemes 4 and 5 are appropriate for solidly-earthed systems in which economy is important and high-speed clearance of earth faults not essential.

Besides the ohmic measuring relays, the units used in these schemes are a timing relay, a phase-fault detector, and earth-fault detector and a directional inverse-time relay for earth faults. As an example of the simplicity and comprehensiveness of the scheme, the following example has been put forward. If a spur line on a new substation is added on a transmission line, a short distance from an existing station, the mho relays at the existing station may have to be changed, but the remaining relays and their connections are unchanged.

Standard Units

The six standard units used in the scheme are as follows:

Timing unit, Type VAT, is operated by a powerful spring, electrically wound and damped by a very strong magnet acting on a copper cup. It has two contacts with independently adjustable times up to 3 seconds. In the same case are three flags for indicating the time zone of operation and auxiliary relays for increasing the distance reach of the ohmic unit.

Phase-Fault Detector, Type VCG, is an induction-cup-type mho unit similar to the mho relay used for distance measurement but less accurate and without the refinements for preventing over-reach on transient conditions. Its characteristics can be offset or reversed on long lines where high ohmic settings are involved. It can be connected for uniform response on all types of faults.

Earth-Fault Detector, Type CAE, contains a residual ($3I_o$) current unit, blocking relay for distinguishing between single and double earth faults, and a tapped auto-current transformer for residual current compensation and parallel line mutual compensation. The transformer tappings enable the compensation to be made accurately for any earth return wire arrangements.

This directional relay is an essential element in its simplified distance protection scheme

Earth-Fault Relay, Type CDD, is a directional inverse-time, earth-fault relay with an instantaneous unit. It is applicable to most solidly earthed systems, instead of another set of distance relays, for single-phase earth faults, because the zero sequence current in the faulted section is almost always greater than in adjoining sections. An instantaneous earth-fault relay unit gives fast clearing of heavy faults.

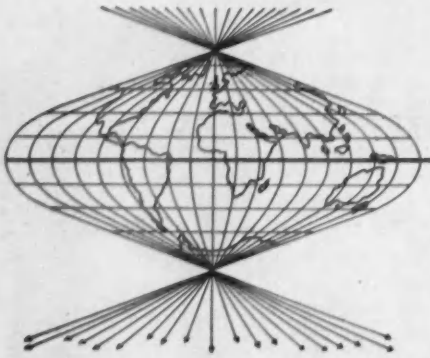
Directional impedance mho relay, Type YCG, is a very accurate, induction-cup type admittance relay with a wide (60/1 ratio) ohmic range and a minimum operating time of less than one cycle. It has strong directional action for faults close to the bus even with zero voltage. It is, in effect, a single unit with combined directional impedance characteristics making it immune to any conditions other than a fault within its setting. It will not operate on any power swing from which the power system can recover.

Reactance relay, Type XCG, is a relay similar to the Type YCG mho relay except that it is current polarised instead of potential polarised. It has the same accuracy (±2% of setting over a wide range of current) and the same speed of operation but is non-directional, and therefore includes a directional unit similar to the mho relay. Both of these relays have a resetting current only 1% less than the operating value. Their distance reach is essentially the same for any fault conditions regardless of offset current waves and other transient conditions.

RESEARCH IN GLASGOW

PROGRESS in all branches of research at the Royal Technical College, Glasgow, are reviewed briefly in "Report on Research, Session 1953-54," recently issued by the College. In the electrical department, under Professor F. M. Bruce, the main work on the power side has been in connection with high voltage and heavy-current phenomena. Calibration work and the building of apparatus for use with an h.v. impulse generator has been pushed forward. Special forms of recurrent surge oscillograph and a recovery voltage indicator have been built, and these have been used to study the transient characteristics of a 132 kV system. Study is also proceeding of arc phenomena in air c.b.'s at currents up to several kA.

Appreciable development in post-graduate work in electronics is noted in the report. A new line of research that has been started concerns non-linear servo-mechanisms. Equipment constructed for the purpose includes a practical servo-mechanism, and two electronic simulators.



OVERSEAS NEWS

A SUMMARY OF IMPORTANT EVENTS

CANADA

More Plant for Brandon

A contract for two 33 MW single-cylinder turbo-generator sets for the new Brandon power station, near Winnipeg, has been placed by the Manitoba Hydro-Electric Board with the Metropolitan-Vickers Electrical Co. Ltd. This brings the total capacity of generating plant ordered for this station to 132 MW, the first two units having been ordered from Metropolitan-Vickers in 1954. Each turbo-generator set for Brandon will run at 3,600 r.p.m., and will incorporate single-cylinder turbines designed for a maximum rated output of 33 MW, the largest output of any single-cylinder machine yet built by Metropolitan-Vickers. The initial steam conditions are 600 lb/s.i.g., and 825° F, exhausting to condenser at 28 in. Hg. The generators will be 13·8 kV machines of the hydrogen-cooled type, using hydrogen at a pressure of ½ lb/sq in. Metropolitan-Vickers, by the way, now have in hand at their Trafford Park Works, generating plant totalling over one million h.p. in capacity for steam and water power stations in Canada.

More Power for Vancouver

Further relief has come to Vancouver Island's power supply with the commissioning of the 35,000 h.p. generator at the British Columbia Power Corporation's Puntledge plant a few days ago. The Commission has not announced any plans for further generating units at the site, although it is understood that a surplus of water power is available. The station is situated on the Puntledge River, and is automatically controlled from the John Hart development headquarters at Campbell River.

Supply in Sechelt

The expected opposition to the plan of the British Columbia Electric Co. (reported on 21 Apr.) to supply the Powell River area has not materialised, and now the company has come to an arrangement with the British Columbia Power Commission. Under this, the company is to purchase the commission's Sechelt generating and distribution system for $2m, and in turn, the Commission will buy the company's 132 kV power line from Nanaimo to Duncan on Vancouver Island. The arrangement, therefore, means that the Commission will relinquish the large Sechelt Peninsula and upcoast areas north of Vancouver, and the company will take these over. Chairman of the Commission Mr T. H. Crosby, has said the commission had withdrawn from the particular region because the B.C. Electric Co. had vastly more power on the mainland than the Commission and the needs exceeded the power the latter had in sight.

U.S.A.

Future Power

America's Pacific north-west area, well known for its large hydro-electric plants, will be relying on steam plants for its basic power load within twelve to fifteen years, in the view of Mr K. M. Robinson, president of the Washington Water Power Co. He stated recently that the days of low-cost power were nearly over; all power developed from now on would cost more and more. Within twelve to fifteen years, the base power load in the Pacific north-west would be borne by steam plants. Hydro-generated power would be used for peak loads and other heavy demands on the power system. There should be adequate power in the area until 1960 or 1961, Mr. Robinson said, but from then on, deficiencies would begin to formulate rapidly. Construction of nuclear power plants would depend on costs. His concern was ready to go into that sphere if and when designs of nuclear reactors were such that they were economical to build and operate.

EUROPE

Another H.-E. Project

Yugoslavia's latest power station, the Jablanica, is now in partial operation, two of its six machines having been commissioned. The four remaining sets are to be installed later this year. Built on the Neretva River, the station is to serve a wide area of Serbia, Bosnia and Montenegro. A dam 255 ft high has been constructed, forming a lake about 20 miles long. The engineering and construction of the scheme has been carried through by Yugoslavs, we understand.

Greek Scheme

A further hydro-electric scheme, with an ultimate capacity of 180 MW, is to be constructed on the Acheloos River for the Greek Public Power Corporation, we learn. This will be Greece's largest post-war development scheme. Its cost is estimated at $45m, of which about one-third will be provided in Italian equipment to clear Italy's reparation war debt to Greece, it is stated. Italian reparations have already provided much of the equipment for two of Greece's hydro-electric projects—the Agra scheme on the river Vodas, north-west of Salonika, and the Louros scheme, in western Greece.

AFRICA

Shire River Scheme

The Federal Government has invited the Nyasaland Government to appoint members to a working committee to study the consulting engineers' report on the Shire Valley project, Nyasaland.

The report of the proposed Shire River hydro-electric project, in Nyasaland, to which we have already briefly referred, suggests that the first stage of the scheme, with a 30 MW power station, would cost £23,631,000 at present-day prices. The ultimate capacity of the scheme is set by Sir William Halcrow and Partners, the consultants, at more than 100 MW, there being a choice of five sites available. It is suggested that power from the station could be integrated into a Federal grid system, once this has been evolved. The report also recommends that a barrage should be constructed on the Shire River in order to stabilise the level of Lake Nyasa and irrigate large areas.

S.W. ASIA

State Boards

As the result of discussions at an Inter-State conference some weeks ago, when the main subject was the setting up of State Electricity Boards in India by States which had not so far taken that step, the deputy minister for Irrigation and Power has indicated that the remaining states are shortly to set up such organisations. Accordingly, the section of the 1948 Act has been further amended by extending the period allowed for the purpose to 31 Mar., 1956. So far only the states of Madhya Pradesh, Saurashtra, Bombay and Delhi have set up their own Electricity Boards.

Gas Turbine Development

A five-year programme of research in India for the development of industrial gas turbines suited to Indian conditions has been adopted by the Council of

Scientific and Industrial Research. The plan, which was drawn up by a Special Committee presided over by Mr J. R. D. Tata and assisted by Prof O. A. Saunders, of the London University, includes the setting up of a research centre at the Indian Institute of Science, Bangalore. A centre of post-graduate training in gas turbine technology is also to be set up in co-operation with the Indian Institute of Technology at Kharagpur and the Bengal Engineering College, Calcutta. Estimated expenditure on the programme is Rs. 13·8 lakhs, spread over 3 years. To implement the programme a committee, with Dr J. C. Ghosh as its chairman, has been set up.

Managing Agencies

A Bill which, if approved by the Indian Parliament, would affect many electricity undertakings in that country, and British firms, is to come before the next parliamentary session. The Bill seeks to abolish the managing agency system by August 1960, or within a three years' date specified by the Government. It is proposed, however, that managing agencies may be given permission to continue if it fulfils conditions required by the Government of India, although they would not be allowed to act for more than ten companies.

Foreign Co-operation

It is reported that the A.E.G., of Frankfurt, have made arrangements to establish a subsidiary in Pakistan, with the title of Pakistan Electric Industries.

MAURITIUS

Development Scheme

A comprehensive programme for the development of electricity in Mauritius, has been prepared by the Central Electricity Board, of which Mr A. N. Bott, M.I.E.E., is the general manager. This shows that only in about 120 sq miles—16% of the territory—is electricity available, and there are approximately 200,000 consumers—39% of the population. Average consumption per consumer last year was just over 900 units but under the development scheme it is hoped to increase that figure to over 1,400 units by 1962. Cost of the main parts of the scheme is estimated at over Rs. 8¼m.

SINGAPORE

Nearing its End

The Singapore City Council propose to close down the old St. James power station next year, we learn. It is likely that the old plant will be disposed of, for plans are under consideration for the redesigning and re-equipping of the station at some future date. At the moment, the Council has arrangements in hand to complete the equipping of the Pasir Panjang power station, which will involve orders for No. 6 turbo-generator and Nos. 8 and 9 boilers, and incidental plant. There are already three 25 MW Metropolitan-Vickers turbo-alternators and five Babcock and Wilcox 187·5 klb/hr boilers in operation, and others will follow shortly. The decision to stop running the St. James power station plant has been recommended because its fuel costs alone have been around 3·5 cents per unit generated, compared with Pasir Panjang's 1·4 cents.

AUSTRALIA

Supplying the Outback

In its plan to install small generating plants in remote centres with populations of between 200 and 1,000 the State Electricity Commission of Queensland has already put into commission 16 oil-engined power stations during the past three years. Similar schemes are being provided at seven other townships, meanwhile investigations are being carried out at a further seven places. Establishment of these electricity schemes has been made possible economically by State Government cash subsidies ranging from 60% to 65% of the cost of erecting the power station, installing the generating plant, switchboard, and ancilliary equipment, and the overhead distribution in the township. Cost of a scheme where three engines are installed is about £22,000. Schemes, including operators' homes, have cost £500,000 so far, of which about £300,000 has been contributed by Government subsidy.

Nuclear Plant

Work will probably begin within a year on the construction of buildings to house Australia's first atomic research station, it has been stated. The plant, initially to include a 10,000 kW nuclear reactor, is to be situated at Lucas Heights, about 20 miles south west of Sydney.

NEW ZEALAND

Finance Needed

The Auckland Electric Power Board is applying to the Local Government Loans Board for permission to borrow £600,000 for further distribution work and general expansion and improvements to supply in its area. The Board wants more than £1¼ million in the next six months, made up of £285,000 still to be raised on a £400,000 loan, the second £400,000 of an £800,000 loan authority and the new £600,000 loan proposal. Mr J. A. Steele, chairman of the Board, has emphasised that unless this loan money is forthcoming the Board will have to curtail its development programme. He has urged the Minister of Finance to make a clear pronouncement on the interest rate for local authority loans.

The first four of eight 10,000 kW generating units were recently put into operation at the McArthur power development of the Manitoba Hydro-Electric Board, shown alongside. Situated 11 miles downstream from Lac du Bonnet, and about 80 miles from the city of Winnipeg, the station is to be completed this summer and will mark the end of the era of hydro-electric development on the Winnipeg River in Manitoba, as it is the last available site. The turbines are fixed blade propeller type runners on vertical shafts operating at 85·7 r.p.m. under a 23 ft head. They are directly connected to eight 8,500 kVA generators operating at 6,900 V, three-phase, 60 cycles. Each generator is connected to the main generator bus through a 1,200 amp, 7·5 kV, 500 MVA air circuit-breaker, the main generator bus being enclosed in a tubular metal chamber and running the full length of the powerhouse. The four sections of the generator bus each feed into a 1,700 kVA transformer in the switchyard where the windings are connected to a 115 kV ring bus from where two transmission lines on double circuit steel towers feed into the h.v. network

Personalities

IN THE INDUSTRY

Chosen for the post of station superintendent at the new Castle Donington power station, East Midlands Division, C.E.A., is **Mr H. Topley,** A.M.I.E.E., M.INST.F., who, for the past 2½ years has held a similar position at the Bankside "A" and "B" power stations, London Division. Previously he had been station superintendent at Derby power station since 1941, after six years in a similar capacity at the Halifax Corporation Electricity Works. Mr Topley gained early practical training at the Mansfield Corporation Electricity Works, and technical training at University College, Nottingham. He afterwards held various positions at Doncaster, Widnes, Padiham and Kearsley, before going to Halifax in 1935 as station superintendent.

After 45 years' service with the British Thomson-Houston Co., Ltd., **Mr Frank J. Hawkins,** A.M.I.E.E., has retired. Internationally known in the lamp manufacturing field, his first of many visits abroad in connection with the industry was in 1916, when he visited the General Electric Co., of America. Last year he was a British delegate at the 50th anniversary meeting of the International Electro-Technical Commission held in Philadelphia, acting as chairman of one of the main committees. E.L.M.A. recently gave him a presentation luncheon on the occasion of his retirement. Having been in office since 1922, he held the record for the longest serving member of the committee. He has also been a member of the I.E.S. since 1910.

Manager of the Wednesbury and Bilston district of the Midlands Electricity Board, **Mr Sidney Raybould,** A.M.I.E.E., has been appointed manager of the Board's Central Gloucester sub-area, as from 23 May. He succeeds **Mr D. Holt,** B.SC.(TECH.), M.I.E.E., who has taken up the managership of the Board's Wolverhampton and District sub-area. Mr Raybould was educated at Bridge Trust Grammar School, Birmingham, and he served a student apprenticeship with the former Shropshire, Worcestershire and Staffordshire Electric Power Co., studying at the same time at the Chance Technical College, Smethwick. He remained in the service of the S.W.S. undertaking until the formation of the Midlands Electricity Board in 1948. From 1935 to 1943 he was chief transmission and distribution operation engineer. In 1943 he became technical assistant to the general manager of the company, Mr D. H. Kenyon, remaining in that post until his appointment in 1945 as the company's district manager at Dudley. In 1948 he became Northern Divisional engineer, retaining that post until vesting day. With the Midlands Electricity Board, Mr Raybould has been deputy district manager at West Bromwich from 1948 to 1949, becoming manager of that district in 1949, and taking up his present position in 1953.

Mr L. Edgar has now taken up the position of group publicity manager for the John Thompson group of companies.

Manager of the British Thomson-Houston Company's Leeds office since Mar. 1948, **Mr H. G. Harlow,** B.SC., M.I.E.E., is taking over the managership of the firm's Newcastle district office on 16 May. He is succeeded by **Mr W. J. Wilson,** A.M.I.E.E., who has been assistant manager at Leeds for the past year. Previously manager of the Newcastle district office, **Mr S. J. Clarke** is taking up another important appointment with the company. After early education at the Merchant Venturer's School, Bristol, Mr Harlow went on to Bristol University, graduating in 1920 with B.SC. degree in electrical engineering, when he joined B.T.H.A. After a practical course in test and other experience in the works, he entered the Design Engineering Department, in 1922; later transferring to the Supply Department—now known as Industrial Machines Department—as a commercial engineer. In 1932 he was transferred to the company's London office as a member of the power sales staff, remaining there until being appointed manager—Leeds District—in 1948. **Mr W. J. Wilson** was educated at Acton and Chiswick Polytechnic and Acton Technical College before commencing his apprenticeship at B.T.H. Willesden Switchgear Works. After periods in the drawing office, Tender Engineers, and Switchgear Contracts Department, he moved to the company's Sheffield office in 1950, remaining there until 1953 when he was transferred to Manchester district for further experience. He became assistant manager at Leeds in Apr. 1954.

Permanoid Ltd. have announced that **Mr P. L. Webb** has been appointed London branch manager and will be responsible for sales in London and the Home Counties. He was formerly with the Telegraph Construction and Maintenance Co., Ltd. **Mr D. Underwood** has also joined the company as area representative for East London and the Eastern Counties. **Mr E. E. Murless** will continue to represent the company in the West and North London areas.

Mr J. C. Dawson, B.SC., A.M.I.E.E., who has now been appointed assistant sales manager, Switchgear Department of the Metropolitan-Vickers Electrical Co., Ltd., has been with the Traction Sales Department for the past seven years. Mr Dawson, who took his degree at Birmingham University, where he was President of the Guild of Undergraduates, joined M-V as a probationary college apprentice in 1934. From 1940 to 1945 he was seconded to the Admiralty as an experimental officer specialising in anti-magnetic mine devices. On completing his apprenticeship, which was interrupted by the war, he joined the Traction Control Engineering Department. In 1948 he transferred to the Traction Sales Dept.

Mr F. J. Hawkins

Mr S. Raybould

Mr H. G. Harlow

Mr W. J. Wilson

Mr J. C. Dawson

Sir Edward Appleton, G.B.E., K.C.B., F.R.S., has accepted an invitation to become President of the Radio Industry Council in succession to **Lord Burghley,** who has held office since 1952. Sir Edward, the distinguished scientist whose research work in the field of radiophysics was largely responsible for the development of radar, was awarded the Nobel Prize for Physics in 1947. He has been Principal and Vice-Chancellor of Edinburgh University since 1949, and for ten years before that appointment was Secretary of the Department of Scientific and Industrial Research. He was President of the British Association in 1953.

Mr A. B. Frost

Mr F. E. Perry

Mr C. Ryder

Mr E. C. Willis, F.C.I.S., manager of Bristol sub-area of the South Western Electricity Board, was presented with a long service award by the Board's chairman, **Mr S. F. Steward,** last Thursday. Mr Willis joined the Bristol Corporation Electricity Department at their office in The Corn Exchange, Bristol, in 1919. He was appointed secretary to the general manager (then Mr Faraday Proctor) in 1929; became secretary to the Corporation's Electrical Committee in 1933; secretary and sales manager of the undertaking in March 1945, and promoted to general manager in October 1945. In the 1930's he was honoured by being elected a Companion of the Institution of Electrical Engineers.

Sir George Nelson, F.C.G.I., M.I.MECH.E., M.I.E.E., chairman and managing director, English Electric Co., Ltd., sailed in the *Queen Mary* last week for America and Canada, to attend the board meetings of the Canadian companies. He expects to be away for about three weeks. He was accompanied by his son, **Mr H. G. Nelson,** M.A.(CANTAB.), M.INST.C.E., M.I.E.E., deputy managing director, English Electric Co., Ltd., who is travelling on to Australia and New Zealand, and will probably be away about two months.

On retiring from his position of manager of the Central area of the South of Scotland Electricity Board, **Mr A. W. Andrews** was recently presented with a television set, subscribed for by his colleagues and friends.

Our accompanying photograph shows **Dr H. D. Einhorn,** A.M.I.E.E., M.(S.A.)I.E.E., senior lecturer in electrical engineering, University of Cape Town, discussing a photometric problem with **Mr J. Studholme,** chief technical engineer of the Benjamin Electric Co., Ltd., at the latter's Engineering Research Laboratory. Dr Einhorn, who is on a visit to England, spent a day at the Benjamin Works in London, where he toured the factories and saw lighting fittings being manufactured for use in South Africa.

Dr Einhorn, right, raises a point with Mr Studholme

Appointed manager of the Northampton lamp depot of the British Thomson-Houston Co., Ltd., is **Mr A. B. Frost,** who, since 1939, has gained experience with the company at Cheltenham, Birmingham and Wolverhampton. He has succeeded **Mr F. E. Perry,** who, after 28 years' service with the company, has left to take up an important appointment with E.M.F. Ltd., of Northampton.

Mr C. F. B. Hippisley has been appointed London sales manager to Brown, Lenox and Co., Ltd. For the past twenty years, Mr Hippisley has been with the Morgan Crucible Co., Ltd.

In conjunction with its modernisation scheme (noted on page 804), British Railways have also announced steps to improve staff recruitment and training, especially on the technical side, necessary in the augmentation of the plan. **Mr A. S. Quartermaine,** who retired in 1951 from the position of chief engineer, Western Region, has been appointed to undertake special duties in connection with the recruitment and training of the technical staff, while **Mr E. J. Larkin,** the assistant mechanical and electrical engineer, London Midland Region, has been appointed to deal specifically with the requirements of the mechanical and electrical engineering departments.

The Metropolitan-Vickers Electrical Co., Ltd., announces that **Mr C. Ryder,** A.M.C.T., M.I.E.E., is now chief engineer, Instrument and Meter Department, succeeding **Mr T. W. Ross,** M.I.E.E., who has been appointed consultant to the chief electrical engineer of the company. Mr Ryder joined the company in 1919 as a draughtsman in the Instrument and Meter Department. In 1921 he was transferred to the engineering side dealing with automatic control schemes, and since 1929 he has been responsible for the design and development of protective and control relays. He was appointed assistant chief engineer in 1950. Mr Ryder is a member of several B.E.A.M.A. and B.S.I. Technical Committees and of the I.E.E. Measurements Section Committee. During the session 1952/53 he was chairman of the I.E.E. North-Western Measurements Group. He is joint author of a number of I.E.E. papers on protective gear and has written a number of articles for the technical press.

Mr F. P. Bowden, SC.D., F.R.S., of the University of Cambridge, has been appointed chief research consultant and in charge of the Tube Investments' Research Laboratories at Hinxton Hall, Cambridge.

Mr Thomas Johnston, C.H., LL.D., J.P., F.E.I.S., chairman of the North of Scotland Hydro-Electric Board, has been told by his medical adviser that he must rest.

The Eastern Electricity Board has appointed **Mr J. Rowe** as general service manager of the Haverhill area, in succession to **Mr H. A. Dunning** who has gone to Weston-super-Mare. Mr Rowe has been on the commercial staff at Bury St. Edmunds for nine years.

Mr T. C. Harrop, the commercial manager of H. J. Enthoven and Sons, Ltd., has been appointed a director of the company in place of Mr A. R. Mathias, who has resigned.

Mr W. H. Rigg has been elected a director of Revo Electric Co., Ltd.

Mr H. G. Partridge, M.A., has resigned from part-time membership of the South Wales Electricity Board, on becoming a candidate for Brecon in the forthcoming general election.

Mr H. T. Ramsay, M.SC., M.I.E.E., F.INST.P., has been appointed Director of the Safety in Mines Research Establishment of the Ministry of Fuel and Power. He succeeds **Mr A. H. A. Wynn,** M.A.(CANTAB.), M.I.MIN.E., who resigned on his appointment to membership of the National Coal Board. Mr Ramsay graduated from London University in 1932. For much of his career he served under Sir Clifford Patterson at the Research Laboratories of the General Electric Co.,

working on the application of discharges in gases to high voltage rectification and related projects. In 1939 this work was found to have applications to radar and his group worked on these problems throughout the war. In 1944 he was appointed to the leading staff of the Laboratories and in 1948 he left the G.E.C. to join the Armaments Department of the Royal Aircraft Establishment where he worked on problems of fighter armament. In 1949 Mr Ramsay moved to guided missile development where he led a group studying associated analytical and electro-mechanical problems. In early 1953 he went to the Headquarters of the Ministry of Supply to supervise a group of major industrial projects associated with this work. In 1954 he joined the Ministry of Fuel and Power and was appointed to the Safety in Mines Research Establishment.

Mr H. G. Palfreman, sales manager of Bill Switchgear Ltd., has also been appointed secretary to the company.

As we earlier forecast, **Lord Chandos** has been elected president of the Electrical Development Association for 1955. The two new vice-presidents for the period 1955-58 are the **Rt Hon Thomas Johnston,** and **Lord Hurcomb.** At the first meeting of the E.D.A. Council last Tuesday, **Mr C. F. King** (chairman, East Midland Electricity Board) was elected chairman, with **Mr D. Bellamy** (chairman, Yorkshire Electricity Board) as vice-chairman.

Mr Ernest Hill, A.M.I.E.E., has been appointed commercial officer, Ayrshire area, South of Scotland Electricity Board. He was formerly commercial officer of the Dumfries and Galloway sub-area.

Deputy station superintendent at Deptford West generating station, London Division, C.E.A., since 1946, **Mr R. W. Bassil,** A.M.I.E.E., has been promoted to superintendent at that station, in succession to **Mr G. H. Whelton,** who retires this month, as we have already noted. After training at Faraday House, Mr Bassil commenced at the Grove Rd generating station of the then Central Electricity Supply Co., Ltd., in 1921 and in 1928 was transferred to Deptford West as boiler house superintendent, being promoted to deputy superintendent in 1946.

Mr D. S. Cumberledge, barrister-at-law, retired from the position of legal adviser to the Southern Electricity Board at the end of April.

OBITUARY

Mr J. Comrie, chief electrical engineer of the Carron Co., Ltd., died on 4 May, aged 67.

Mr H. F. Downing, sales manager of The Phoenix Telephone and Electric Works Ltd., died on 12 Apr., aged 52. He had been with that concern nearly 25 years, most of the time as sales manager.

Mr B. F. McMurtrie, O.B.E., who for some years was chief of the B.T.H. Export Department, at Rugby, has died in South Africa, aged 75

Mr R. P. Hilton, A.M.I.E.E., manager of Cobra (Wood Treatment) Ltd., died on 7 Apr.

Mr L. J. E. Hooper, chairman of Doulton and Co., Ltd., died on 8 May, aged 76.

NEW LITERATURE

How to Read Workshop Drawings

by L. Longland. Revised by E. W. Twining.

ALTHOUGH, as the title suggests, this book is written for the layman who knows nothing of engineering drawings, it could quite profitably be read by students who are about to embark on an engineering career. After a brief introduction to the subject giving details of conventions and various views the book considers particular subjects, such as gear wheels, riveting and crankshaft bearings. With many illustrations and clearly written text, this book is well worth its modest price. Published by Percival Marshall, 63 pages, 7¼ in. by 5 in. Price 3s. 6d.

Radar Pocket Book

by R. S. H. Boulding, O.B.E., B.SC., M.I.E.E., A.M.I.MECH.E., F.INST.P.

THE aim of this book is to provide, in a reasonably small compass, information on the basic electrical principles and formulæ particularly applicable to radar, together with data on various parts of a radar installation. Opening with an explanation of the theory of electromagnetic wave propagation and basic radar principles, the book moves on to discuss thermionic tubes, crystal rectifiers and transistors before dealing with circuit calculations and waveforms.

The main theme is then reached with a discussion of various types of transmitters and receivers and, subsequently, transmission lines, reference being made to the Smith diagram. Waveguides, horns, and cavity resonators are then described together with aerial systems and radiation. Published by George Newnes Ltd., 176 pages, 6¼ in. by 4¼ in. Price 15s.

Practical Lessons in Metal Turning and Screw Cutting

by Percival Marshall.

IN the revised edition the text is mainly as before, but opportunity has been taken to include many new photographs of work in progress. A new chapter has been added which discusses the various parts of a lathe for the benefit of those who are novices. Tools, tool holders, chucks and other devices are described and the best method of tackling jobs is given. Not the least useful, is the section on screwcutting. Published by Percival Marshall, 178 pages, 7¼ in. by 5 in. Price 6s.

BOOKS RECEIVED

Electric Traction Engineering by E. A. Binney. Further volume in publishers' Electrical Series, intended for junior engineers entering the industry and for others with some experience of it. Published by Cleaver-Hume, 224 pages, 7¼ in. by 4¼ in. Price 15s.

Electric Transmission and Distribution Ed. by Bernhardt G. A. Skrotzki. One of four books in the "Electric Utility Library," it deals, in a practical manner, with the various components of transmission and distribution systems. Published by McGraw-Hill, 448 pages, 9¼ in. by 6¼ in. Price 56s. 6d.

Automatic Transmissions by Instructional staff of the Commercial Trades Institute, U.S.A. Describes automatic transmission systems now used in many American cars, for both technicians and students. Published by McGraw-Hill, 406 pages, 9 in. by 6 in. Price 49s.

Electricity, Direct and Alternating Current by C. S. Siskind. New edition with detailed revision to raise level of material to make it more suitable for use in educational establishments. Second edition, published by McGraw-Hill, 538 pages, 9 in. by 6 in. Price 43s.

Lamps for a Brighter America by Paul W. Keating deals with the history of the development of lamps from Ediswan's time until today. This is also a survey of the activities of the American G.E. lamp business. Published by McGraw-Hill, 246 pages, 9¼ in. by 6¼ in. Price 30s.

Automatic Feedback Control System Synthesis by John G. Truxall. A complete and up-to-date presentation of the methods used in design of feedback systems. The work is advanced, dealing with linear systems in detail. Non-linear systems are also mentioned. Published by McGraw-Hill, 675 pages, 9¼ in. by 6¼ in. Price 89s. 6d.

Radar and Electronic Navigation by G. J. Sonnenberg, new edition; enlarged to include new chapter on direction finding and additional material describing new developments. Second edition, published by Newnes, 288 pages, 8½ in. by 5½ in. Price 31s. 6d.

Picture Book of Wales. One of the "Country Life" picture book series and includes views of districts associated with hydro-electric schemes. Published by Country Life Ltd, 58 plates, 11¼ in. by 8½ in. Price 12s. 6d.

Code of Practice for the Annealing of Polystyrene Mouldings. Report of a special sub-committee of the Technical Committee of the Injection Moulders Section of the British Plastics' Federation; dealing with general purpose grades of polystyrene. Published by the British Plastics Federation, 47 Piccadilly, W.1, 4s. post free.

Magnetic Control of Industrial Motors by G. W. Heumann, reflects, in this new edition, modern developments in the design of control components and systems, and is intended for motor application engineers. Second edition, published by Chapman and Hall, 714 pages, 9 in. by 6 in. Price 86s.

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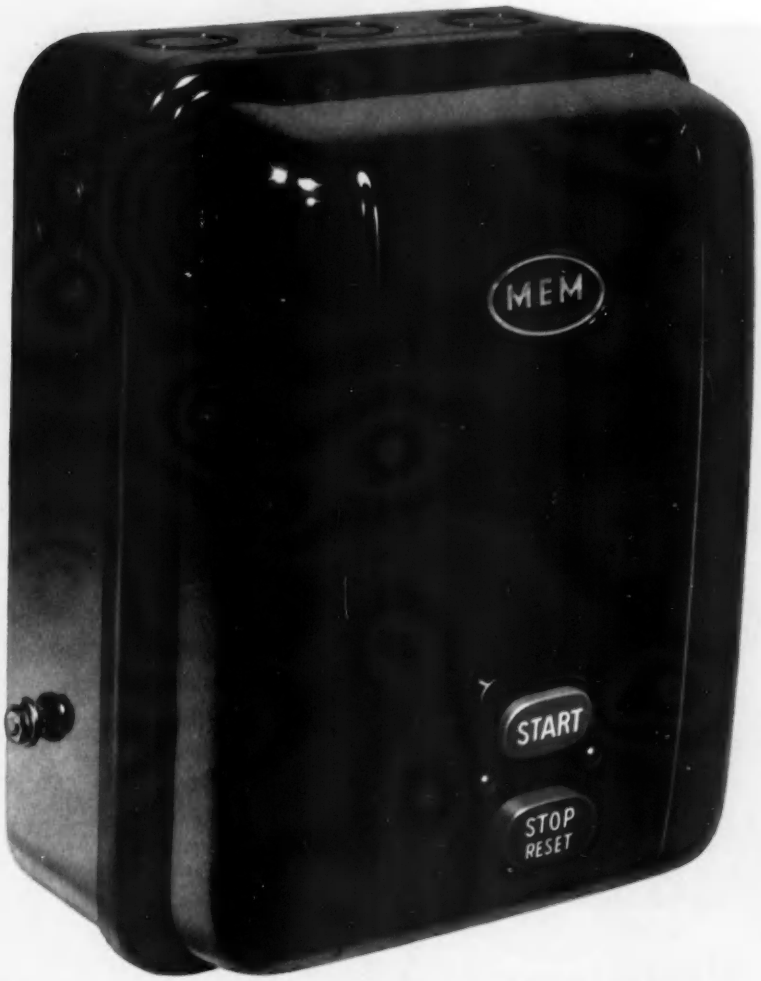
THE NEW MEM 'Autoline' STARTERS 1½ to 15 h.p.



Do you want the finest possible starter for valuable machine tools and other vital applications? Then here is your answer from MEM, the people with more than 30 years experience in large scale production of Motor Control Gear. The Autoline is new from start to finish, and is designed to stand up to heavy duty for a very long life and give complete protection to the motor. Outstanding features include :

- *Unit construction to meet a wide variety of purposes from one set of standard units.*
- *Precision overload relays with heaters designed specifically for individual motor ratings.*
- *One starter for both auto and manual resetting.*
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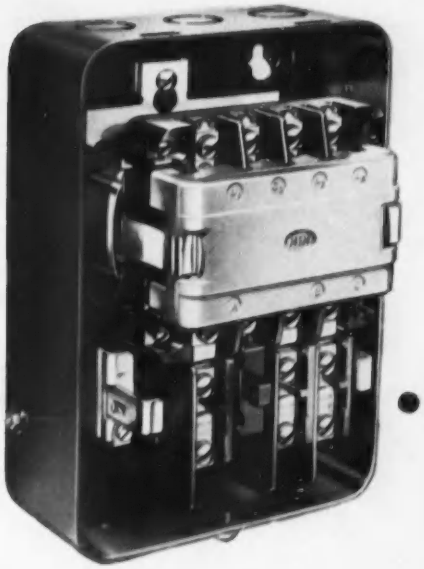

Send for the 'Autoline' Brochure List No. 347

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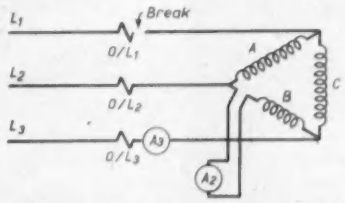
PROBLEMS AND PRACTICE

In Engineering

Single Phasing

A RATHER unusual fault was disclosed recently after a squirrel cage had undergone a general strip down for examination and cleaning. One of the stator phase windings showed every appearance of excessive heating, the insulation at the end turns being scorched and brittle. Insulation and drop tests revealed no actual fault so the end turns were re-taped and the motor rebuilt. The star-delta starting switch incorporated on the machine driven by this motor was examined, and an explanation for the overheated winding was forthcoming when one of the three over-current coils was found open-circuited due to a loose connection.

The over-current coils were not in circuit in the "star" position and bought into circuit in "delta." The motor had thus run up to a certain speed on three phases in star and had continued to run as a single phase motor in delta connection, but with an unbalanced loading of the stator windings. Before repairing the faulty starter a test was made to find a reason for the two sound overload trips not operating, and ammeters were fitted



Sketch showing position of break in the O/L coil to cause single phasing, and location of ammeters

into circuit as shown in the sketch. The motor full load current was 7·5 A, which, with the 50% overload setting of the trips would require a minimum line current of 11·25 A before operation. The readings, taken whilst the motor was driving the machine on normal duty, which, incidentally, was approximately 75% full load, were: A_2 in over-heated stator phase B, 13·5 A; and A_3 in the line 3, 10·7 A. These show the motor line current to be only 140% whilst the phase B winding was carrying 180%, a condition which could continue under these circumstances until a winding failure resulted.

The damaged over-current coil was later repaired and all trip settings reduced to 25% overload, but even this does not give full protection should single phasing occur whilst the motor is running under full load, for the heavily loaded phase may carry 50% overload with a load on the motor of only ½ to ¼ of full load.

This particular case, though unusual, does serve to illustrate a possible cause for single phase burn outs due to insufficient protection, and there are now several makes of motor starter, which incorporate single phase preventors and core balance protection, that could be relied upon to prevent such a near motor failure as that described.—*T. H. Snelson.*

Every engineer has a story to tell; why not tell yours on this page? We welcome contributions to this feature, and those published will be paid for at our standard rates. Problems which are encountered and overcome in day-to-day maintenance or installation of electrical plant; useful methods and techniques developed for specific jobs, or current practices, all make instructive reading for others. We will also consider for publication problems requiring an answer. Sketches are often helpful and need only be rough, as they will be redrawn before use.

Cable Economy

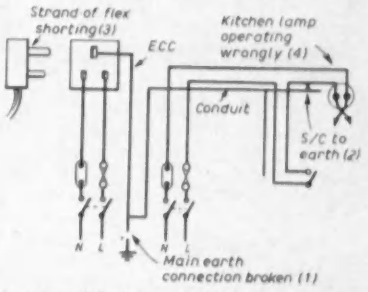
THE contributions relating to my original monograph of the 14 Apr. on 2-way switching perhaps indicate that there is a growing awareness of the need for new ideas to cut cable costs in wiring. Although some of the methods were ingenious I am unrepentant in the belief that, under the circumstances cited, my procedure is the most economical. I can assure J. Hooper that I have seen 2-way switching wired in scores of newly-built houses by running a switch pair from the light point to one switch and then linking the two switches by means of 3-core cable. The method of using a joint box may be applicable to finished buildings but is hardly suitable to the hurly-burly of building sites, where often the building trades are on piece-rates. In any event, additional joints add to the time and material and can lead to loose connections with their attendant dangers of overheating, radio interference, and the like.

Mr Satchwill expresses the opinion that three or four feeds would result in overcrowding of the cables at the light point outlet, if my method was used. Four feeds at any point is to be deprecated at all times. If the outer sheathing is cut to a minimum length I have found that no crowding occurs with three feeds. Again, I am against the use of single-core cables, as there is always the danger of its being placed in a protecting conduit by itself and thereby contravening I.E.E. Wiring Regulation 405 (N) which states that, "Cables installed in metal conduits shall always be so bunched that the outgoing and return cables are drawn into the same conduit." I would also consider it bad practice to wire the hall and landing lights on the same circuit as a blown fuse leaves the entire staircase in complete darkness.—*M. N.*

Uncommon Result of Fault

TWO apparently long standing faults on an electrical installation were brought to light accidentally by the occurrence of a third fault which introduced a fourth and some unusual symptoms.

The writer sent an electrician to investigate a kitchen light which suddenly came on and could not be switched off.



Location of faults on the lighting and power circuits, the original faults 1 and 2 being shown by fault 3, and causing faulty operation of the lighting switch

A new switch was taken in anticipation of the usual broken spring or sticking contacts after short-circuit, but the existing switch was found to be in perfect condition, although wiring appeared to be in the neutral. Calling in myself as I was passing, I was in time to join in the amazement that the heating main switch, when accidentally put off preparatory to a "Megger" test on the lighting installation, put out the kitchen light. This, however, could now be operated normally from its local switch which was correct polarity. Operation of lighting main switch again put light out.

At this stage I was told that a new 13A plug had recently been fitted to an electric fire in lounge, and as a matter of interest, I decided to check it. On removing plug, the kitchen light returned to normal. The trouble, although difficult to imagine, was obviously caused by the plug or fire. Opening up the plug showed one strand of flex from the earth conductor, touching live side of fuse. This meant that the socket was not earthed or the strand would have fused. Further tests showed that the 13 A socket, connected with twin and earth t.r.s. cable was bonded at meter position with several conduits including lighting, but that the main earth connection was broken and insulation test indicated that kitchen switch line was "earthing" on conduit, these two faults, having, it seemed, existed for some time.

The circuit energising the kitchen lamp was then easily traced, and having found this, of course, rectification of all the faults was simple.—*E. Copeland.*

Equipment for Industry

Versatile Hydraulic Platform

A VERSATILE machine which has been specially designed for use on jobs which normally require scaffolding, or other rigging, has been introduced by SIMON HYDRAULIC MACHINERY, Queens Cross, Dudley, Worcs. It comprises a platform which may be positioned anywhere in space up to a height of 36 ft and a maximum radius of 23 ft from the base. This platform, which is large enough to accommodate two men and their tools, is supported by means of a radius arm which has a fulcrum at its centre. This arrangement enables the wide range of positions to be obtained since the two halves may be moved independently.

Hydraulic power for the platform is provided by a small i.c. engine directly coupled to a pump. The various movements, which are valve-actuated, are controlled from the platform, "up" and "down" pedals being provided for both halves of the radius arm and rotation being effected by a knee-operated control. The engine, control valves and other ancillary equipment are mounted on a turntable base which is usually arranged for mounting onto a lorry chassis of 3 tons or over having twin rear wheels. To ensure safe operation when the platform is in the fully extended position on either side of the lorry, outrigger jacks are provided. Other safety features include automatic cut-outs and provision for motor failure, in which case the platform stays in position until lowered by the operator.

In the illustration this equipment is shown being used for maintenance of street lamps. It is also ideal for overhead power and telephone lines.

A "machine of a thousand uses", the Simon hydraulic platform is here being used to service a street lamp

Improving Soldering Technique

IT is often said that the secret of good work lies in the choice of the right materials, and this is probably more true in soldering operations, such as jointing and wiping cables, than in many instances. Solders have to be "designed" for the job, since composition is the all-important factor in determining the range of temperatures over which they remain liquid. When tinning conductors, the solder has to be such that it will penetrate all the strands but will not run straight through and out of the ferrule before setting. For this to be achieved the tin content of such solders is generally around 45%. In the case of wiping cable joints, different conditions have to be fulfilled and the tin content is therefore reduced to around 30%.

The operator is using Fry's "Abbey" metal in this wiping operation

Fluxes are also important, since they must be "active" to prepare the metal quickly for soldering, and "safe," that is they should have no tendency to corrode the metals. To assist in selection of suitable solders and fluxes for various jobs and to help understanding of the problems involved, FRY'S METAL FOUNDRIES LTD., Tandem Works, Merton Abbey, S.W.19, have produced a booklet entitled "Solders and fluxes for cable jointing."

In this they describe a wiping metal, "Abbey," which has been specially developed and is claimed to remain in a plastic state over a range of 113° F. The advantages of this are at once apparent and, in fact, the firm state that joints can be completed without reheating. By virtue of its fine grain the metal is said to give a smooth texture to the wipe.

In the field of fluxes the firm produce "Alcho-Re," a paste which is claimed to combine the desirable "active" and "safe" features. Official approval for it use has been obtained from Admiralty, M.O.S., and other responsible bodies.

Foot Switches for Control Circuits

FOR control of contactor coil and magnet circuits used on machine tools, cranes and other equipment, DONOVAN ELECTRICAL CO. LTD., 70-82 Granville St, Birmingham 1, have introduced three types of foot switch. All have floor fixing cast dust-proof cases and are fitted with foot pedals suitable for mounting on either side. Latching devices may be provided where required, but with these it is recommended that some form of under voltage protection be used, to ensure safety to the operator.

Style "S," has single-pole double-break roller type copper contacts, either normally-open or normally-closed, and in standard form a spring-return to the "off" position is provided. This feature may be omitted where spring breakage is liable to have dangerous consequences. With style "H," silver plated contacts of n/o or n/c double-break pattern are fitted, and a built-in gravity return to the "off" position is provided. These two units are styled heavy duty, having an a.c. rating of 2 A continuous 10 A peak at 550 V. They incorporate self-lubricating bearings.

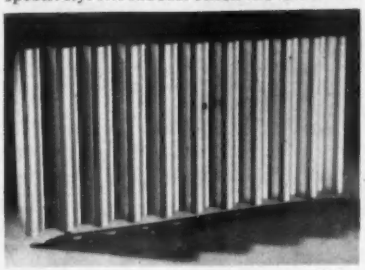
In the lighter pattern, style "L," a gravity return for single-pole double-break contacts is fitted, and the rating at 550 V is 1A continuous or 3A peak. The foot pedal is arranged in the box width.

Donovan foot switches have right and left fixing pedals, they are enclosed in robust cases

An Unusual Radiator

UNUSUAL in both construction and design the electric radiator introduced by YELSEN LTD., 9 Hatherley Rd, Sidcup, Kent, makers of electric blankets, provides an extremely efficient and comfortable method of heating.

Basically a sheet of insulating material, into which are sewn the heating elements, pressed between two aluminium sheets, the Yelsen Radiator provides a heating medium in which the heat source is distributed over a large surface area giving a low running temperature (about 160° F). There are four models, 601, 603, 606, 610 loaded ¾, 1, 1½ and 2 kW respectively. All models reach the maximum



Unusual styling is evident in the new Yelsen electric radiator

temperature of 160° F and the working temperature is reached within 10-15 minutes of switching "on." Average loading is about 184 B.Th.U. per sq ft (less than 60 W per ft). The radiator is fitted with an infinitely variable thermostat fitted centrally and coupled to a neon circuit indicator and is available for voltage ranges 200/220 and 230/250 V. Standard finish is stove enamelled bronze and prices range from £10. 10s. plus £3. 15s. 10d. p. tax to £21. 10s. plus £7. 15s. 3d. purchase tax.

Erratum

IN our reference last week to the new Crusader water heater by SIMPLEX ELECTRIC CO. LTD., we gave a wrong price. It should be £10. 10s. plus p. tax.

TRADE PUBLICATIONS

ALUMINIUM.—Northern Aluminium Co. Ltd., Banbury, Oxford, have issued a new publication on "Welding Aluminium." It gives helpful data on alloy processes and procedures and weld strengths.

MOTORS.—New publication from Lancashire Dynamo and Crypto Ltd., St. Stephens Hse, Victoria Embankment, S.W.1, include List AI a list giving present day prices of a.c. protected and T.E. fan-cooled motors up to 250 h.p. and T.E. motors up to 20 h.p. List B15 which supplies full information regarding outputs and dimensions of the new A.A. L.D.C. range of S.C.R. motors protected and T.E. fan-cooled types having interchangeable fixing dimensions. These motors are also interchangeable as regards outputs and fixing dimensions, with the American new N.E.M.A. and Canadian new C.E.M.A. protected and T.E. fan-cooled 60-cycle motors. List J2 is a revised list of L.D.C. fractional h.p. motors indicating machines in stock for immediate delivery.

LIGHTING.—Details of the "Side of House" lantern are to be found in Publication SL.2.55, issued by Holophane Ltd., Elverton St, S.W.1.

Price Increases

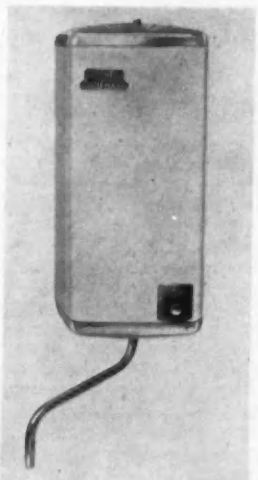
DUE to the steady increases in material costs and overhead charges during the last few months, and the recent wage award CONTACTOR SWITCHGEAR LTD., Moorfield Rd, Wolverhampton, have found it necessary to increase their prices. From 2 May, 1955, all manufactures have been advanced in price by approximately 10% but where there are outstanding tenders, prices will stand up to 31 May for home customers and 30 June for export.

GEORGE H. SCHOLES LTD., Wylex Works, Wythenshawe, Manchester, have also issued a new Price list No. W.915 effective from 2 May, which gives new prices for equipment listed in Catalogue W.910.

Revo Electric Ltd., Tipton, Staffs, have issued a revised price list for industrial reflector fittings as described in Catalogue No. 18 and note percentage increases from 10-15% on many of their products effective from 2 May.

New Mitchell Water Heater

REFLECTING modern styling in both design and name, the new "Streamline" over-sink type storage water heater by MITCHELL ELECTRIC



LTD., 80-90 Tennant St, Birmingham 15, makes a handsome addition to the up-to-date kitchen. Simplicity of appearance is achieved by incorporating taps and other fittings in the outer case, so that only the swan-neck outlet pipe protrudes, thus making for easy cleaning. It is available in two sizes—1½ gallon, 750 W rating at £17. 17s. 6d. and 3 gallon, 1kW rating at £20. 16s. 4d., tax paid in both cases. Other features include a water non-return device, anti-drip control and water pressure adjuster whilst it can be supplied in colour finishes of white, cream, pastel blue and pastel green, with chromium plated top and base.

For the Electrical Trade

Shock Tester for Wolseley Fence

TO enable the owner of an electric fence unit to check the condition of his fence line accurately and satisfy himself as to the degree of efficiency of the installation, WOLSELEY ENGINEERING LTD., Wolseley Works, Electric Ave, Witton, Birmingham 6, have introduced a shock tester. Pocket sized, this instrument consists of a plastic cylinder at one end of which a small adjustable wheel and hook is mounted and at the other end a flexible cable leading to an earth spike attached. The spike is first pushed into the ground and then the instrument is hooked on to the fence line. The knurled wheel is then rotated clockwise until the neon light built into the unit ceases to flash. The reading on the wheel at this point indicates the condition of the line insulation.

The Regency Fire

NEW model period fire introduced by BERRY'S ELECTRIC LTD., Touchbutton Hse, Newman St, W.1, is the No. 20 "Regency" fire. Measuring overall 21½ in. wide, 23½ in. high and 18½ in. deep the fire will stand conveniently in the normal fireplace fitting. Width across the basket is only 13½ in. with depth 14½ in. Heat control method is unusual, full control is effected by the turning of a small lump of coal clockwise. Finish is antique bright rustless finish and the price £32. 10s. 6d. plus £12. 13s. 9d. tax.

OVERCOMING DIFFICULTIES IN MALAYA

Domestic Expansion follows more Settled Conditions

WITH local conditions becoming more settled, the Central Electricity Board of Malaya report an increase of 15·8% on the total number of units sold during the twelve months ended 31 Aug. last. With the tin mining industry affected by fluctuations in the price of that metal, sales of electricity to that industry were about the same as for the previous year, but noteworthy advances were recorded by domestic and industrial consumers. Total sales amounted to over 241 million units, of which 46 millions were by domestic consumers (an increase of 28·3%) and nearly 70 millions for industrial power (an increase of 41·8%). It is evident from the report that the considerable efforts made to extend domestic electrification, including the holding of exhibitions, are now reaping their rewards. Advantage was also taken of the Government's programme for providing security lighting in new villages. This programme, although halted and the plans subsequently revised, had been virtually completed at the end of the year covered by the report. It provided for 120 villages to be equipped with 12 kW or 25 kW diesel alternator sets, a further 36 obtaining electricity supplies direct from the existing Board's licensee systems. The Board has subsequently secured domestic load in most of these villages, but it is unlikely that it will ever be possible to maintain such supplies on an economical basis. (Total cost of operating and maintaining the new village installations during the year was $1·2 millions, but energy sales amounted to only $400,000.) The question as to what shall be done with these village supplies after the need for security lighting has gone has yet to be answered, it is stated. The Board's hire-purchase scheme for domestic appliances again made further progress, refrigerators, cookers and fans in particular, being in demand.

Expansion Plant

In fulfilment of plans to meet anticipated growth in demand, one 20 MW set in the second stage of Connaught Bridge power station is now on load and a second machine is scheduled for commissioning this year. This will probably take care of the load up to 1958, beyond which further capacity will be required. The Board are considering plans for a new steam station near Malacca, which would have an initial capacity of 20 MW, to be operating in 1959, with additional stages to raise installed capacity to 40 MW. With an improvement in the security situation further surveys have been made for a proposed 120 MW hydro-electric project in the Cameron Highlands. It is anticipated that such a station could be commissioned in about ten years.

Work is also being pushed ahead on several transmission line projects, but the development of the 66 kV system, which includes the provision of a third 66 kV interconnector between Connaught Bridge and Bungar power stations, presented considerable technical difficulties, and discussions have taken place with the equipment manufacturers. As a long-term development it has also been agreed that a new line to the proposed 20 MVA substation at Rawang shall be insulated for 132 kV but operated initially at 66 kV—at the moment the highest transmission voltage of the Board.

Line Troubles

In the year covered by the report, over 108 miles of h.t. lines of various voltages were added to the Board's systems, and 26,893 kVA of additional substation capacity was commissioned. It is stated that the number of recorded earth faults on both the 66 kV and 33 kV systems was very much higher than for the previous year. Extremely violent storms were largely responsible but apparently the Petersen coil on the 33 kV system and the two coils on the 66 kV system once again gave satisfactory service and cleared 71·2% and 79·5% respectively of the recorded earth faults. Flying foxes coming into contact with o.h. lines, particularly in the Port Dickson and Klang areas, also caused considerable trouble. A section of the 11 kV line at Port Dickson was reconstructed with much greater conductor spacing which, with the fitting of repeater type fuses, considerably improved matters.

On the generation side again we note that at the end of August last, the Board had 36 diesel stations in commission, a total of 2,996 kW of new plant being installed during the period, while a further 2,720 kW of new plant was on order. In all, the diesel plant generated over 36 million units, representing 13·7% of the total units generated by the Board's undertakings.

Finally, the year's operations were also very satisfactory financially, a balance of $4,695,074 being transferred to the net revenue account.

Railway Modernisation

ANNOUNCED last week were the first steps towards the fulfilment of the modernisation plans of British Railways. During 1955 and 1956 it is hoped to proceed with the improvement or strengthening of existing tracks with associated resignalling to cope with higher speed. In the same period some 1,000 multiple-unit diesel vehicles and at least 170 new main line diesel locomotives will be ordered. Diesel shunters will continue to grow while electrification of certain suburban services and preparation for major main-line works will be undertaken. Rolling stock is to be improved and new freight wagons of large capacity built.

To cover this portion of the programme the Transport Commission has placed orders with British manufacturers to the extent of some £35m. Track and signalling programmes include the four-tracking scheme between New Barnet and Potters Bar (Eastern Region) costing about £2¼m which is now a prerequisite of electrification. The multiple-unit diesel trains will be introduced on the Edinburgh-Glasgow, Birmingham-Swansea, London-Hastings, East Anglia, Lincolnshire, Newcastle-on-Tyne-Carlisle, Newcastle - on - Tyne - Sunderland - Middlesbrough, Manchester (local) North Wales, Birmingham (local) and Hampshire routes. As a preliminary to the main dieselisation plan, the Commission has approved the introduction of 170 new main-line diesel locomotives for trials work. These will be of three main types, "A" being 600-800 h.p., "B" 1,000-1,250 h.p. and "C" 2,000 h.p. and over.

The specifications for these locomotives provide for up to three units of Types A and B to be worked together as a multiple unit if required, and two locomotives of Type C to be operated similarly.

The Liverpool Street-Shenfield extension to Chelmsford and Southend due to be completed by the end of 1956 will form the basis of further electrification to Ipswich, Clacton, etc. Preliminary planning work is in hand for the Liverpool Street-Enfield, Chingford, Hertford and Bishops Stortford scheme, and preliminary work is planned for the Fenchurch Street-Tilbury and Southend scheme. The Kentish electrification will continue and first steps taken towards the preparation of a plan for the Euston-Birmingham-Manchester-Liverpool scheme.

Marshalling yard reconstruction will be necessary at Ripple Lane, near Barking (£1·8m), at Temple Mills, Stratford (£2½m) and at Colwick (1¾m). In the Scottish Region a marshalling yard is to be built at Alloa (£500,000) to deal with new pits now being sunk in the Fife area, and another yard has been authorised at Millerhill nr. Edinburgh. A new yard at Port Talbot, in South Wales, to cost £1¼m will also be put in hand.

Up to £1m will be spent in the next two years on building mineral wagons of the 24½ ton class, and provision is being made for the fitting of continuous brakes on new wagons. This will cost over £3m. Progress toward standardisation of 24½-ton mineral traffic wagons must be governed by the rate of adaption of terminal facilities for handling these larger units.

NEWS OF THE WEEK

Copper at £280 per ton

New R.S.T. Quotation will remain for at Least 30 Days

IT WAS announced in Lusaka last weekend that the Rhodesian Selection Trust's fixed price for copper to U.K. consumers under the new arrangements will be £280 per ton for the first 30 days at least as from 9 May. As reported in these columns last week the Trust offered a fixed price to those consumers willing and able to instil a degree of stability in resale prices. The price would be effective for a minimum of 30 days, but subject to alteration at 24 hours notice at any time afterwards. Copper affected by the new plan is the blister copper (sold at a discount) which forms the main output of the Trust's mines. This is purchased in this country principally by British Insulated Callenders' Cables, Enfield Rolling Mills and I.C.I., all of whom welcomed the original announcement of the offer. The price of £280 per ton may be compared with the London Metal Exchange's quotation for electrolytic copper, which closed on Friday night at £304 a ton for cash copper, and £290. 15s. a ton for forward metal. On Tuesday night the Exchange's prices had risen to £305.

15,000 tons of Copper for Sale

TENDERS for the sale of 15,000 tons of electrolytic copper for pricing and delivery over five months beginning next month have been invited by the Board of Trade. This is part of the unsold balance of 45,000 tons of electrolytic copper, which the B.o.T. announced they intended to sell last month. There are about 28,000 tons to be sold, and the remaining 13,000 tons are to be offered for sale at a later date. Applications for tender forms should be addressed to Room 3166 at the B.o.T.'s offices in Horse Guards Ave, London, S.W.1.

Powder Metallurgy Congress

THE second International Powder Metallurgy Congress is to be held at Reutte, in the Austrian Tyrol, between 20 and 23 June. Choice of the same centre for this year's Congress is because Europe's largest powder metallurgy company, The Metallwark Plansee, is situated there. Topic of the Congress, which is sponsored by Dr Paul Schwarzkopf, president of the American Electro Metal Corporation, will be High Temperature and Corrosion-Resistant Materials. About 300 representatives of 17 countries, including 30 U.K. delegates, are expected to be present. The Austrian company is represented in Britain by George Cohen Sinteel Ltd.

£63,000 Compensation for I.o.M. Undertaking

DOUGLAS Corporation has been awarded £63,000 compensation against the Isle of Man Electricity Board in the Corporation's claim in respect of losses sustained in the three years the Board ceased to take a bulk supply. The arbitrator, Mr R. W. Gregory, M.I.E.E., M.CONS.E., the consulting engineer, has directed that the costs of the award, £1,099, should be shared equally by the Board and the Corporation. The latter claimed £148,926 compensation, maintaining (as we reported on 3 Feb.) that it had incurred expenditure in installing additional plant at Pulrose power station to meet the demand in Douglas and in expectation of the bulk supply to the Board continuing.

Industrial Safety

VENUE of the National Industrial Safety Conference will again be Scarborough. Organised annually by the Royal Society for the Prevention of Accidents it will take place this year between 20 and 22 May. All meetings will be held in the Spa Theatre, and a record number of stands has been booked for the trades exhibition which will be held in an adjoining hall.

U.K. Firm acquires Control of Canadian Company

NEGOTIATIONS have now been completed for the acquisition of 99% of the shares of Amalgamated Electric Corpn. Ltd., of Toronto, by the General Electric Co. The association will have an important long-term effect in the co-ordination of the British company's business in Canada, which until now has been carried out by the British General Electric (Canada) Ltd., formed in 1949. They will be able to supplement their exports to Canada with facilities for local assembly and manufacture of equipment to Canadian requirements. The purchase of control of the Canadian organisation is a direct result of Mr Leslie Gamage, vice-chairman and joint managing director of the G.E.C.'s recent visit to Canada at the end of his round-the-world business trip, and was foreshadowed in our issue of 31 Mar.

The Amalgamated Electric Corpn. was formed in the 1880's and has a factory of over 200,000 sq ft in Toronto, with a smaller works in Winnipeg. There are sales branches also in Montreal, Calgary and Vancouver. Products include distribution and lighting equipment, motor control apparatus and wiring supplies. The Corpn. will remain essentially Canadian in character and under its present management, with Mr A. V. Armstrong at the head. Mr Gamage, Mr D. G. W. Acworth, manager of G.E.C.'s export department, Mr J. B. Taylor, managing director of the British General Electric (Canada) Ltd., are to join the board.

CAST IRON SCRAP PRICES

CONTROLLED prices of cast iron scrap have been increased in most areas following consultations between the Minister of Supply and the Iron and Steel Board. An Order bringing the new prices into effect came into operation on Monday. The increases are designed to encourage the movement of cast iron scrap between areas of surplus and areas where there is a shortage, it is stated.

Eight Firms to form Nuclear Power Corporation

EIGHT firms led by C. A. Parsons and Co., Ltd., are to pool their resources in the design and manufacture of nuclear power plant. A new corporation is to be formed with an authorised capital of £1m. Only one of the companies who have accepted Parsons' invitation to join the group has been named so far, and they are Head, Wrightson and Co., the Thornaby firm who have great experience in heat-transfer equipment and experimental nuclear reactors. Since 1948, the Parolle Electrical Plant Co., Ltd., jointly owned by Parsons and A. Reyrolle and Co., Ltd., have been co-operating with the Atomic Energy Authority on the industrial application of atomic energy. The company is closely connected with the Calder Hall project.

Reports from Newcastle suggest Shields Rd as a possible site for the new project, and that permission is being sought to build a light railway across the road.

Local Section of A.P.L.E. formed in Bristol

A SECTION of the Association of Public Lighting Engineers has been formed to cover S. Western England and S. Wales. Decentralisation of this Association has been a topic of discussion among members for some time past and during the last twelve months two sections have been established. They cover the N.E., Lancashire, Yorkshire, Scotland and the Midlands. Inaugural meeting of the S. Western section took place in Bristol a short time ago. It is hoped that it will encourage greater local interest than is normally possible at the annual conference. It is also hoped that by making meetings more readily available, all those interested in public lighting would be able to attend.

Chairman of the new section is Mr N. Axford, Plymouth district manager with the S.W. Electricity Board, and Mr F. H. Pulvermacher, illuminating engineer with the S. Wales Board as hon. secretary and treasurer. Mr J. B. Bennet, Bristol's city engineer is vice-chairman. There is also a committee of eight, representative of the three Electricity Boards, two Gas Boards, manufacturers and local councils.

As regards future activities, it was decided to hold two meetings a year. The next will be in Bristol in the autumn.

OFFICIAL PUBLICATIONS

RURAL ELECTRIFICATION. U.N. Report as at July 1954. Available from H.M.S.O. 6s.

N. WALES H.E. POWER BILL. Special Report from Select Committee of House of Lords (see page 809) H.M.S.O. 2d.

OVERSEAS ECONOMIC SURVEY. Venezuela, H.M.S.O. 3s. 6d.

IRON AND STEEL SCRAP (Amendment No. 1) ORDER, 1955. H.M.S.O. 2d.

BRITISH STANDARDS. B.S.938; 1955: General Requirements for Metal-Arc Welding of Weldable Structural Steel Tubes.

CANADIAN WELDING QUALIFICATION CODE. Information on. Available from B.S.I. (ref: PD2179), 2 Park St, London, W.1.

Diamond Jubilee of College

AT a celebration of the diamond jubilee of the College of Technology in Birmingham recently honorary associateships of the College were conferred on five men who have risen to control large undertakings in Britain, and associateships of the College were awarded to 128 men and women in Midland industry who completed advanced studies there.

Among the six who received hon. associateships was Mr A. B. Waring, chairman and managing director, Joseph Lucas Ltd. Of the 128 who were awarded associateships, 15 were students in the electrical engineering department.

Technology and Science Week in Portsmouth

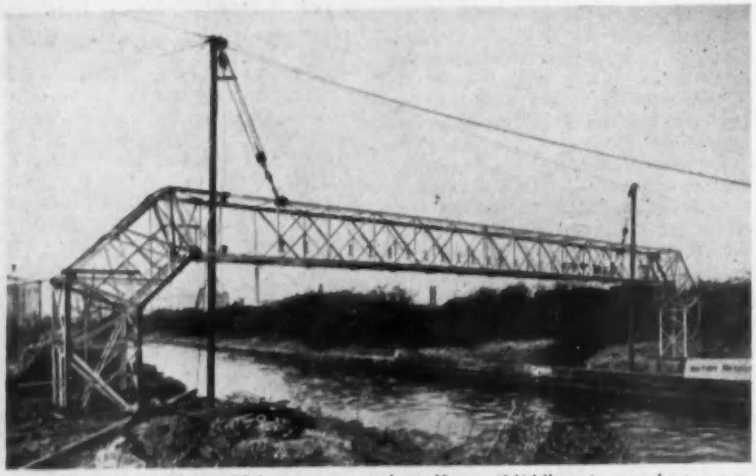
IN Portsmouth throughout next week (16–20 May) a Technology and Science Week is to be held to help parents, teachers and schoolchildren to know more about opportunities for careers in industrial undertakings. The industrial exhibits, films and lectures will all be at the College of Technology in Guildhall Sq. The week will comprise five main lines of activity. There will be scientific and technical exhibits mainly of local concerns, technical films, works visits, popular lectures and visits to departments of the College. The electrical industry, both supply and manufacturing, will be well represented. A number of electrical firms, associations and the C.E.A. and Area Board, are exhibiting. Admission is free.

Scunthorpe to do Their Own Street Lighting Repairs

DISSATISFACTION with the repair and maintenance work carried out by the Yorkshire Electricity Board has led Scunthorpe borough council to set up their own organisation to look after their street lighting. Agreement in principle to the idea of a council maintenance organisation was reached at the last monthly meeting. The borough engineer is to submit a more detailed scheme to the council at a future meeting. Meanwhile the public lighting committee estimated that the cost of establishing such an organisation would be about £7,200, and it was envisaged that the minimum staff required at the outset would be one chargehand or foreman, one journeyman electrician and two lighting attendants.

There was a difference of opinion as to whether the council was, in fact, dissatisfied with the Yorkshire Board's work. Councillor L. Hornsby, committee chairman, said the new department would cost about £700 p.a. more than they were paying the Board. At present they were not getting value for the money expended on providing a new system of street lighting and on improvements. He said he did not want to criticise the Y.E.B. too much because he knew of their labour problems and also of the good work they were doing in the electrification of rural areas. He said he was convinced the arrangement would improve the street lighting service in the town.

Earlier Councillor J. A. Sturman asked if it could be stressed that the decision was no slight on the Board. But Alderman D. Todd contended that it was because they were dissatisfied with the Board's work, saying he agreed with the move because by doing the job themselves they would get a better service.



A cable gantry with an 82 ft span, erected at Hayes (Middlesex) recently to carry 33 kV cables and accessories across the Grand Union canal. Weighing 4 tons, it was built by British Insulated Callender's Construction Co., Ltd., for the Southern Electricity Board as part of the contract for supplying 33 kV oil-filled cables between North Hyde substation and Springfield Rd, Hayes

E.T.U. MEMBERS OBJECT TO FINES

FOLLOWING disciplinary action by the Electrical Trades Union against most of the 120 members, employees on the maintenance staff of J. Lyons and Co., Ltd., out on strike last year, who returned to work without permission of the Union's executive, many of those employees have refused to pay the fines imposed. We gather that 41 of the men were fined £1 and suspended from union benefits for five years. About 50 of the maintenance staff concerned have written to the E.T.U. maintaining that the original dispute was unnecessary, that the leadership was inadequate, and in view of the hardship inflicted upon the strikers, they were justified in returning to work to end the strike. The men apparently consider it unreasonable to be expected to pay union contributions while deprived of benefits. They are considering forming an electrical branch of the Transport and General Workers' Union.

The men have apparently objected to what they consider Communist influence in their branch of the E.T.U. At Cadby Hall, the electricians' shop committee has resigned, and the men have agreed not to recognise the union's shop steward.

IMPRESSIONS OF RUSSIA BY E.T.U. DELEGATION

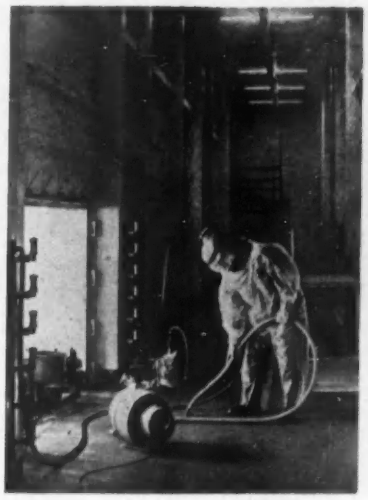
DOMESTIC electrical appliances, such as washing machines and refrigerators were becoming commonplace in Russia, in the view of a ten-man delegation of members of the Electrical Trades Union who have just returned from a 3-weeks visit to that country. The delegation was led by Mr J. Humphrey, a member of the union executive, and Mr L. Gregory, a union national officer. The cleanliness inside power stations, and the greater emphasis on maintenance work were among other points which impressed, but there were many more workers, including women, per power station than in Britain. They considered that great strides were being made technically in Russia, although such things as plastic covered cables were only now being used there. The delegates were also impressed by the vast scale of the Kakhovka multi-purpose project on the Dnieper River, which is to have six 52 MW sets operating on a maximum head of 48 ft. For this, a dam has been built across the river where it is nearly a mile wide. The dam is nearing completion, and the station will probably commence operating later this year.

Help for Exporters of Welded Fabrications

FURTHER assistance to exporters of engineering equipment in meeting the various standards and requirements existing in Canada, is given this week in the form of a booklet published by the British Standards Institution. It concerns welded fabrications for export to Canada, and is the result of arrangements which have been completed for the certification in this country of welded fabrications destined for Canada. The booklet is entitled "Information on the Canadian Welding Qualification Code," and sets out in detail both the procedure adopted in Canada for certification and the arrangements now agreed for carrying out that work in the U.K.

The First Half-Century

The lines of the Paris Metropolitan Railway run in the main east and west, and any attempt to use it for getting from north to south involves a roundabout journey as bad or worse than that of our own Inner Circle. It is stated that the Paris municipality has now authorised a north and south tube. The new railway will differ in many respects from the "Metro." In the first place it is to be a deep level tube of the British kind not a shallow tunnel, and secondly it is to be constructed by private capital without any partnership of the municipality in the business. The interest of the municipality is confined to levying a tax of a tenth of a penny on every ticket, and more if the traffic exceeds a certain amount, as well as taking a share in the profits from station advertisements and miscellaneous receipts.—*From our issue of 11th May, 1905.*



The vacuum cleaner shown above will be of little use to housewives. It is a special type made for the collection of radioactive dust by Hoover Ltd., at their Perivale, Middlesex, works. It was designed to meet the requirements of the Atomic Energy Research Establishment. To date 80 of these vacuum cleaners have been supplied or are being made

I.E.E. Annual Report

COPIES of the Annual Report of the Council for 1954/55 and of the Accounts for the year ended 31 Dec., 1954 (to be presented at the Annual General Meeting on Thursday, May 19, 1955, at 5.30 p.m.), can now be obtained by members of the Institution of Electrical Engineers on application to the secretary.

L.C.C. consider Employing Electronic Mechanic

INSTALLATION and maintenance of electronic equipment in L.C.C. schools should be undertaken by a new grade of electronic mechanic, the Council's Establishment Committee is recommending. Electronic equipment used in the Council's schools, homes and other premises at present includes about 2,500 radio sets, 63 TV sets, 1,157 cinematographs and 1,075 film-strip projectors, as well as over 1,500 other items. Installation and servicing is done by 12 electricians, but it should be done by specialised engineers, the committee state. They are suggesting that the new rate of pay for an electronic mechanic should be 3½d. an hour above the trade rate for an electrician in the contracting industry.

Manchester E.T.C.T.A. Now have 115 Members

REMARKABLE progress has been made in the establishment of a Manchester branch of the Electrical Trades' Commercial Travellers' Assoc. Membership of 115 is already stated to exceed that of the Midlands' branch. A social subcommittee is already hard at work and arrangements are being made to hold a luncheon in October, whilst it is rumoured that a Ladies' Evening will be held in the interim period. Chairman of the new branch is Mr R. H. Corlett of Hardman and Co., Rochdale, and secretary is Mr W. Smith of Ega Electric Ltd. Membership is open to all "on-the-road" within a radius of 40 miles of Manchester.

DEVELOPMENT PROGRAMMES

East Anglia's £9m Current Programme is double that of 1948-49

A REVIEW of achievements to date and some idea of plans for future electrical development in the area were given by Mr G. N. Green, chief engineer of the Eastern Electrical Board, at a meeting of the Consultative Council last Friday. Capital development programme during the current year, he said, would amount to about £9 millions which was double the £4½ millions expended in 1948-49, the first year of nationalisation. Now in the middle of their second five-year plan, the Board hoped that by 1958, they would have connected 110,000 rural premises, including some 12,400 farms. The latter figure, Mr Green commented, compared very favourably with the 10,000 farms connected by the numerous undertakings before Vesting day. Speaking of what the Board intended to do this year, Mr Green said they were accelerating their rural development programme, and intended to spend about £1½ millions for the benefit of the rural community. The higher rate of construction was being achieved by carrying out the work in larger zonal schemes in order to increase productivity in all departments.

Over £3m to be Spent in West Country on Electrical Development

A RECORD capital programme of £3,300,000 this year, nearly 20% more than last year, to reinforce electricity networks and extend supplies to rural areas, industrial and commercial premises and new housing estates, was mentioned by S.W. Electricity Board chairman, Mr S. F. Steward, in Taunton, on Friday. In this way, he said, the West Country was being prepared for all the benefits which nuclear power would bring to the community.

Mr Steward pointed out that the growth in the industrial load was still outpacing the increase in the domestic demand. To secure a better balanced load in the supply system, and thus keep the price of electricity down, it was essential to encourage the widest and most diverse use of electricity in the home. Keen salesmanship and really good service in every one of the Board's 109 showrooms were an essential part of their policy. Mr Steward was presenting the challenge cup in the Board's Window Display Competition to the Taunton Service Centre.

A model of Sylvania-Thorn's Colour TV Laboratory to be built at Enfield, which was accepted for exhibition by the Royal Academy

Modern Colour Television Laboratories at Enfield

A MODEL of the design of Sylvania-Thorn Laboratories Ltd's new colour television laboratories to be built on the Great Cambridge Rd, at Enfield, was accepted for the summer exhibition of the Royal Academy, which opened at Burlington Hse on 30 Apr. The building, designed by Mr G. A. Jellicoe comprised three blocks. A three-storey laboratory is on the left in our photograph, connected by a five-storey link block to the offices on the right, which comprise four floors The two top floors of the laboratory are clear and unobstructed, allowing for changes in layout at any time. All operating machinery for heating, refrigeration, dust extraction and air compression is on the ground floor but is isolated from the rest of the building. In the centre of this floor there is a staff tea room, and access is provided through glass doors to a promenade extending 20 ft over an ornamental lake. The centre block will house lifts, air conditioning plant, water tanks and service equipment. The entrance hall in the office block passes completely through the full building height and contains the main staircase with the central column as a lighting feature, inside which fluorescent lighting extends from floor to ceiling. General lighting will be mainly fluorescent.

G.E.C.'s New Showrooms at Gloucester and Ipswich

TWO new showrooms have been opened in recent weeks by the General Electric Co. in Gloucester and Ipswich. Original premises in St. Aldate St, Gloucester, which were opened in 1931, became wholly inadequate to meet increased business of recent years. The new showrooms in Great Western Rd occupy a floor space of 18,000 sq ft containing offices, store, service and showroom facilities. On the ground floor there are modern showrooms, stockrooms, trade counter, receiving and despatch departments, and on the first floor, offices and stockrooms. Second floor is devoted to stores and a staff room. The whole building lies back from the road with its own drive in. The showrooms are well furnished and provide a comprehensive display of electrical equipment. That devoted to cookers, refrigerators, and other domestic appliances is equipped for demonstrations to the trade.

Magnet House in White House Rd, Ipswich, is among the first to be built in an area scheduled for light industrial development. Slightly smaller than their Gloucester counterpart, the premises cover 10,000 sq ft of floor space. Once again there are modern showrooms for the display and demonstration of domestic appliances and adequate arrangements for servicing and stocks. The company first went to Ipswich 36 years ago and their new premises is about double the size of the former offices.

First Showroom outside London opened

THEIR first service centre outside London has been opened by Kenwood Electrics Ltd. It is at 49 Candleriggs, Glasgow, and will be operated in conjunction with S. W. Cohen Ltd., the company's distributors in Scotland.

Siemen's Swansea Shop

NEW sub-stores have been opened by Siemens Electric Lamps and Supplies Ltd. at Swansea. They are situated at 36 Wind St, and form an extension of the company's Cardiff branch. The Swansea stores and trade counter will be managed by Mr W. A. Cooper.

Opening ceremonies at the General Electric Co.'s new showrooms at Ipswich (right) and Gloucester (below) were performed by Mr C. T. Melling, Chairman, Eastern Electricity Board, and the Mayor of Gloucester, Clr H. A. Gibson. Mr Leslie Gamage was present on both occasions. Below left is a general view of the main showroom at Gloucester.

Holophane fittings installed in the control room and turbine bay at the C.E.A.'s S. Wales Division's Carmarthen Bay power station

Modern Lighting Installed at Carmarthen Bay

MAKING use of their specialised technique in the prismatic control of light, Holophane have provided the control room, turbine house and adjoining railway sidings at Carmarthen Bay power station with a modern lighting installation. Flush ceiling Centrolens provide an average illumination of 20 lumens per sq ft on the control room panels. They are fitted with blue tinted reflector assemblies giving improved colour quality with tungsten lamps. Holophane twin translucent units in the main turbine bay are mounted at a height of 50 ft. Each houses a 1,000 W tungsten lamp and a 400 W MA/V mercury discharge lamp. Smaller units are employed in the side bay housing 500 W tungsten and 250 W mercury lamps. Illumination of the sidings is by floodlight projectors fitted with 1,500 W lamps on 50 ft steel columns. Supply and installation of the equipment was carried out by Metropolitan-Vickers Electrical Co. Ltd.

NEWS IN BRIEF

British and French Nuclear Energy organisations have reached an agreement on exchange of information. Object of the agreement was said to be to develop peaceful uses of nuclear energy.

An electronic device to be known as the tin technical assistant, at the B.B.C.'s Wrotham station, will ensure that the early morning radio programmes go automatically on the air.

Presentation of Long Service Awards took place recently at the Bootle works of the Liverpool Electric Cable Co., Ltd. Messrs A. Squire and J. Catherwood, who retired last year, were given gold watches in recognition of 50 years' service, while eight others received certificates and awards after 25 years. Awards were presented by Mr E. L. Wildy, managing director.

About 400 stockholders of Associated Electrical Industries Ltd. last week visited their main factories at the invitation of Lord Chandos, chairman. Special trains from Euston took parties to the Metrovick works at Manchester and the B.T.H. factory at Rugby.

Guest of Crompton Parkinson at their Chelmsford works recently was Rear-Admiral Sir Philip Clarke, who is director of the Naval Electrical Branch at the Admiralty.

G. and J. Weir Ltd., are making a bonus payment of £5 plus £1 for each year's service, to all employees with over three months' service. The gift is to mark the company's diamond jubilee.

Scottish Fuel Efficiency Committee are co-operating with the Scottish Education Department in promoting a fuel efficiency campaign in 3,000 schools. Lectures and demonstrations will be given to janitors and administrative officials in the 33 educational areas before schools reopen in the autumn.

QUESTIONS IN PARLIAMENT

N. Wales H.E. Scheme

THE report of the Select Committee of the House of Lords on the N. Wales Hydro-Electric Power Bill states that the committee are satisfied that a good case has been made out, and that the effect of the schemes sanctioned by it on the hill pasture and agricultural land will be as small as possible. The Bill gives power to the C.E.A. to construct two hydro-electric stations in N. Wales.

Street Lighting

IN a written answer last week Mr J. A. Boyd-Carpenter said he was always ready to encourage improvements which would reduce road accidents. He said he had the whole question of the administration of street lighting under consideration. Mr Page had asked whether in view of the Road Research Board's report, better street lighting could reduce accidents at night by 30%.

Single Wire System

ATTENTION was drawn last week to the use of single wire high-voltage distribution of electricity used in Australia and New Zealand as a means of reducing the cost of supplying electricity to rural areas. Mr V. M. Vane suggested that the C.E.A. should carry out experiments on an appropriate scale this year. Mr L. W. Joynson-Hicks said the single wire system had not been adopted in this country so far because of the greater danger to the public and of interference with communications. There may be places where such a system could be used, and he understood the Southern Board had undertaken an experimental scheme and a number of other experiments were proposed.

London's Electric Signs

ASKED by Lt-Col M. Lipton what limit was to be imposed on the size of electric signs along the South Bank of the Thames, Mr D. Sandys said no hard and fast standards were applied. Lt-Col Lipton pointed out that Lambeth Council were trying to impose a 3 ft limit on the size of lettering and that each time an aggrieved advertiser had appealed against that ruling, the Minister had decided against the council. He asked whether the sky was the limit, and whether the Minister was aware that an application for a 13½ ft sign was pending. Mr Sandys said he too had once been a member for Lambeth and could assure the questioner he had no prejudice against them.

Factory Inspectorate

QUESTIONS about the cost of the factory inspectorate were asked by Dr B. Stross, who later suggested that despite increases in outlay there would appear to be evidence in support of strengthening the inspectorate both numerically and in status if it was to do all its work. Mr H. Watkinson told him expenditure dur-

ing the 1954-55 financial year had totalled £727,400 compared with £217,169 in 1938-39. Figures were not available for additional costs incurred. As regards strengthening the inspectorate, it was nearly up to full strength numerically, and he was fully in agreement with increasing its status.

Clean Air Bill

PRELIMINARY consultations with persons and organisations interested in the Clean Air Bill were now nearly completed, Mr D. Sandys stated in a written answer last week. He added that he hoped to be in a position to make a further statement early in the next session.

Merchandise Marks

ASKED by Mr R. S. Russell if a decision had been taken on the withdrawal of the option under the Merchandise Marks Act, 1926, which allowed imported goods to be marked Foreign or Empire, instead of the name of the country of origin, Mr P. Thorneycroft said he was still considering the views of Commonwealth and Colonial Governments. All those opinions had not yet been received.

National Service

A SUGGESTION that men training to become electronic engineers should be exempt from National Service, was made by Mr C. Osborne, who pointed out that the Americans were offering salaries of £3,500 p.a. plus numerous other incentives to engineers, who in this country received about £1,400 p.a. Mr Harold Watkinson, replying, said he was aware that vacancies in the U.S. were advertised in Britain. Deferment was already given to men on approved courses of study leading to a recognised professional qualification in engineering. Mr Watkinson agreed that it was necessary to increase the number of electronic engineers, and said that was why they tried to give them deferment.

Electricity Supplies in Dorset . . .

NO figures were available concerning the number of farms supplied with electricity in Dorset during the past three years, Mr D. Heathcoat Amory stated. He explained the county came under two different Area Boards. He promised to look into the Compton Abbas West Orchard scheme, which Mr R. F. Crouch alleged had been in abeyance for a long time.

. . . and in Norfolk

THE number of farms connected in Norfolk during the past five years was given by Mr Amory in a written answer next day. He pointed out that figures were not available for the county, but for the Norfolk sub-area of the Eastern Board which covered about 90% of the county. In 1951, he said, 283 farms were provided with electricity, the figure dropping to 158 in the following year and to 144 in 1953. 292 farms were connected in 1954 and the 1955 figure was 397, making a total of 1,274.

ELECTRIC SUPPLY NEWS

Argyll

The North of Scotland Hydro-Electric Board's Glen Shira scheme is to be officially inaugurated on 28 May.

Belfast

The question of prices of coal supplies to the Corporation Electricity Department was raised at last week's meeting of the City Council. One member, Mr H. Granston, moving the reference back of minutes of the Electricity Committee dealing with tenders for coal, asked if it was a fact that importing concerns did not fill in the tender forms but returned them blank. He recommended that they should co-operate with Londonderry Corporation by importing coal in ships of their own. Before authorising expenditure of over £1 million on coal, the Council should know all the facts, he said. Ald J. MacGougan also advocated that Belfast should organise on a municipal basis, the collection of coal from the pitheads, but Mr H. Holmes, M.P., denied that any importer got a hidden commission or that anything crooked or unfair was going on.

Bristol

The allegation that substations of the South Western Electricity Board within the city were in a "deplorable state" (reported in our 28 Apr. issue) has been thrown back at the city council by Mr E. C. Willis, manager of the Board's Bristol sub-district. In a letter to the Council he has stated that every endeavour is made by the Board to keep such sites clean and tidy and for this purpose the Board's workmen visit the sites, but as soon as they are cleared, rubbish, including in some cases old bedsteads, prams and garden refuse is again dumped. The Board is put to considerable expense by wanton damage to their buildings. In one case after repeatedly replacing broken tiles it had been necessary to re-roof the building with corrugated iron. In another instance over 2 cwt of stone was removed from one roof. The use of close-boarded fences has also had to be abandoned because these were damaged and the wood stolen. Mr Willis offered to meet members of the Housing Committee to discuss the problem. Ald C. R. Gill, chairman of the committee, said he had visited some of the sites, some of which had been disgracefully treated.

Eastern Board

Consumers connected by the Eastern Electricity Board during Jan. and Feb. were 4,051 and 4,717 respectively. Of these, farms numbered 140 in Jan. and 119 in Feb. Mains extensions carried out during the same two months totalled 32·1 miles of l.v. and 31·6 miles of h.v. during Jan. and 34·4 miles of l.v. and 45·9 miles of h.v. during Feb.

Fort William

The British Aluminium Co., Ltd., has notified the Town Council that it has abandoned the scheme to divert the head waters of the River Nevis. The company has explained that its negotiations with the North of Scotland Hydro-Electric Board regarding tapping the head waters of the Nevis had not been concluded satisfactorily. It was, therefore, not proposed to proceed further in the matter.

Glasgow

The cost of reorganising and re-equipping the Corporation's Pinkston power station is likely to be over £2,700,000, it is now stated. The work is due to be completed next year. So far £2,300,000 has been spent on the scheme. Before the work was put in hand, the capacity of the station, which supplies the Corporation's transport system, was 48 MW, all at 25 cycles. At the present time, capacity has been raised to 54 MW, partly at 25 cycles and partly at 50 cycles. Next year the full output of 68 MW will be at 50 cycles, when the station will be able to feed into the grid system if necessary, for the transport services only require 41 MW now, and with the policy of scrapping some 300 old vehicles, it will drop to 33 MW.

Northern Ireland

A survey just completed to give detailed information about peat deposits in Northern Ireland indicates that these were more suitable, in all the circumstances, by the size, nature and location, for uses other than burning for the generation of electricity, Lord Glentoran stated in Stormont recently.

South Shields

The Town Council has considered a report by consulting engineers on the possible effects of the Central Electricity Authority sluicing ash from the proposed Blyth power station, into the sea. The report stated that although there was no likelihood of immediate danger to South Shields beaches from the depositing of ash into the sea, the beaches may be affected in 10 years time. The Council has decided, in conjunction with other local authorities, to continue its opposition to the C.E.A.'s arrangements for disposing of the ash.

LIGHTING SCHEMES

Derby. Three street lighting improvement schemes are proposed, estimated to cost £7,328.

Leatherhead. The Council is to proceed with £17,500 scheme for improved street lighting.

Ripon. T.C. has approved a scheme for lighting of Malorie Park Drive, Studley Rd, Clotherholme Rd and Kirkby Rd, at a cost of £4,866.

COMPANY ACTIVITIES

Mr Leslie Gamage, vice-chairman and general manager of the G.E.C. doesn't let grass grow under his feet. During the last fortnight of a recently concluded world business tour he sews up the group's business in Canada by the purchase of 99% of the shares of Amalgamated Electric Corpn. Ltd. of Toronto. He has officially stated that this association has, for the G.E.C., the important long-term aspect of co-ordinating its business in Canada. Amalgamated Electric Corpn. has been established for 75 years. Its products include electrical distribution and lighting equipment, motor control apparatus and wiring supplies.

Every week something confirms my view that the electrical and allied industries are one of the best wickets in the industrial world. Sir Claude Gibb, chairman of C. A. Parsons, the electrical and turbine engineers and makers of optical and scientific instruments, has appraised the situation thus: "A study of the demand for electricity in many countries of the world shows the necessity to prepare for a doubling of consumption approximately every 10 years." So he sets his men to work out plans for a large-scale extension and replanning of production. This will include the removal of a considerable proportion of the group's facilities to a new site where there is adequate land for still further expansion in the future.

Sir Claude and his directors have great belief in the future of nuclear energy. They are well off the mark in that direction on their own behalf and in association with others. On the financial side they also seem to be well equipped at the moment. Liquid assets amounted to £1,600,000 at the end of last year. In addition, there are free reserves of nearly £5,000,000 covering an issued equity of £3,600,000. Reyrolle's control a 40% interest, and the remaining £1 Ordinary shares quoted at 65s. yield only 3·1% on the latest 10% dividend which, however, was covered seven times over.

In the case of Telegraph Construction and Maintenance, negotiations are proceeding for the purchase of a privately-owned company engaged in the manufacture of closely allied products to meet the increased scale reported in the company's end-year activities. This improvement came after some hesitancy in the earlier months of the year. The subsequent improvement with the over-all order book has brought it up to near-peak levels. The possible weak spot is the power cable outlook, though I should imagine the group is well equipped to meet this challenge. Capital resources are reasonably ample for the moment, partly because of a Preference issue last June. If the present negotiations are successful, it may be necessary to make an Ordinary share issue on favourable terms to present shareholders. At the moment the Ordinary are quoted at 36s. 3d. to yield 4½% on the 8½% payment.

In view of the vital need for this country to increase production, I wonder whether Mr H. Richards, chairman of Wolf Electric Tools (Holdings) Ltd. was unduly pessimistic about his group's future, at the recent annual meeting. He told shareholders that the present phase of prosperity which the country is enjoying might not be quite as firmly based as might appear. He felt that internal inflation and the adverse trend in terms of trade might present serious problems. —*From our City Correspondent.*

Aberdare Cables (Holdings) Ltd.

The 1954 group trading profit of £478,576 was a record. For 1953 it was £436,882. Mr F. G. Penny, the chairman, states that substantial orders have already been obtained for 33 kV cables at home and abroad as the result of the test house research at Aberdare. For South Wales Switchgear Ltd., the turnover and profit last year exceeded 1953, and the company began 1955 with a large order book.

Aerialite Ltd.

A rights issue of one new 1s. Ordinary share at 4s. for every three 1s. Ordinary shares held, is announced. These new shares will participate in the final dividend for the year ending 31 May, which it is expected will not be less than 26½%.

Barton and Sons Ltd.

The group trading profit for 1954 is £737,605 (*£605,824*), and after all charges, including taxation, is £290,487 (*£214,947*). There is a final dividend of 10%, plus bonus 2½%, making the total 17½% (*15%*).

British Vacuum Cleaner and Engineering Co.

Application has been made to the C.I.C., for permission to make a one-for-one scrip issue, which will rank for all dividends, in respect of the current financial year.

Cape Asbestos Co. Ltd.

With the group profit for 1954 increasing to £1,256,015 (*£1,038,963*), the directors are raising the total distribution to 12½% (*25%*) with a final dividend of 10% on capital increased by a one-for-one scrip issue, and a subsequent rights issue in the proportion of 11 for 30.

Copeland and Jenkins Ltd.

Applications were made last week for quotations for the whole of this electrical and electronic company's issued capital, which consists of 150,000 6½% Preference £1 shares and 600,000 Ordinary 10s. shares. S. G. Warburg and Co. have placed privately 135,000 Preference shares at par and 398,000 Ordinary shares at 12s. 6d. each. Dealing began on Monday, the Ordinary at around 17s. and the Preference at 20s. 3d.

Crofts Engineers (Holdings) Ltd.

Consent of the C.I.C. has been received to the capitalisation of reserves in an issue of further Ordinary shares for cash, Sir Arthur Croft, the chairman, stated at the annual meeting last Thursday.

Drayton Regulator and Instrument Co. Ltd.

Turnover during 1954 reached a record figure, with the favourable trading conditions, Mr B. T. Wingfield, the chairman, reports. Yet the value of outstanding orders was higher at the end of the year. During the first three months of the current year the volume of orders received and the output slightly exceeded those for the corresponding period last year. Some difficulty is being experienced in obtaining regular supplies of certain raw materials, however, and it is impossible at this stage to give any reliable indication of the current year's results that are likely to be achieved, he adds.

Year to 31 Dec.	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	178,751	63,951	156	30	5/4	4/6
1951	193,988	71,475	175	30	7/3	4/11
1952	191,224	55,362	129	32½	7/4	4/6
1953	217,203	70,655	165	35	7/9	7/1
1954	278,185	114,283	87	30*	5/9	2/5

*Plus 200% capital bonus.

W. Edwards and Co. (London)

The group net profit, after tax, is £59,064 (*£39,254*). The dividend is 25%, as was forecast.

Enfield Cables Ltd.

The loss for 1954, although disappointing, will not have been unexpected by the shareholders in view of his remarks last year, Sir Philip Warter, the chairman, states. Viewing the prospects for the current year, he expects a modest profit. There is a good deal of reorganisation and re-equipment to be done, but the measures now in hand should enable the company to improve its competitive position. During 1945, about £100,000 was spent on plant and equipment, including two more continuous vulcanisation extruders with ancillary rubber mills for rubber cable production; a new continuous bright annealing plant for copper wire, high speed stranding machines, and considerable modern handling equipment. During the year moulded plugs and sockets have been vigorously developed, and a range of transformer cable boxes produced at the Tottenham engineering factory. The company is planning a new technical laboratory which will provide testing facilities second to none for h.v. cables in this country, he adds.

Glenfield and Kennedy Holdings Ltd.

The group trading profit for 1954, £1,391,675 (*£1,308,972*) was a record.

although trade in the first half of the year was by no means easy. But improved conditions in the second half of the year enabled the works to produce results substantially better than anticipated, Hugh Cowan-Douglas, the chairman, states. Orders on the whole are coming in reasonably well, although profit margins are having to be pared in view of the recent wage award.

Hopkinsons Ltd.

A record output was achieved last year, the directors report. Export sales were again in excess of orders. Trading conditions abroad are more difficult by

Year to 31 Jan.	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1951	844,484	349,939	183	25	6¼	5⅛
1952	868,022	345,380	181	27½	5⅝	96/10
1953	921,366	350,137	176	32½*	81/6	60/–
1954	1,002,048	376,646	94	20	6¼	78/9
1955	1,088,166	482,488	117	25	7⅛	5⅝

*Plus 100% capital bonus.

reason of restricted imports in various countries brought about by shortage of sterling or internal economies, but every possible step is being taken to maintain the volume of export orders.

I.S.T. Insulations Ltd.

The profit for the year ended 31 Mar. is £47,832, compared with an estimated £36,400 for the previous year. The dividend is at the rate of 15% per annum.

Lacrinoid Products Ltd.

This plastic concern reports a net profit after tax, of £8,289 (*£6,161*) and the dividend is again 10%.

Laurence, Scott and Electromotors

The steady increase in turnover during the past few years is reflected in the figures in our accompanying table. Mr G. H. Wilson, the chairman, reports that although a year ago output had overtaken incoming orders for the first time since the war, from the middle of the year the volume of orders took a strong upward turn, including some large export contracts. There was, however, a small decrease in outstanding orders at the end

Year to 31 Dec.	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	431,313	134,063	55	12½	14/1	12/6
1951	495,122	168,707	72	15	16/6	12/3
1952	593,605	185,313	79	15	13/6	9/9
1953	680,888	198,286	73	20	14/6	11/10
1954	761,413	298,323	57	12½*	15/–	7/1

*Plus 100% capital bonus.

of 1954 due to some substantial cancellation of orders in connection with the Defence Programme. To provide improved facilities for the drawing offices, technical departments and general offices at the main works, a new block, with a canteen is to be erected, involving capital commitments of about £320,000. A further £100,000 is allocated to plant replacements reserve.

Newman Industries Ltd.

Increases on material costs and wages have to be faced this year, but with the demand for the company's products still high, continuing the progress of the last

Year to 31 Dec.	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	95,583	3,068	1	6	4/3	2/7
1951	189,146	26,761	14	10	3/10	2/6
1952	179,367	20,664	10	10	3/–	2/–
1953	169,841	24,890	12	10	2/10	2/–
1954	185,965	26,504	13	10	2/7	2/–

few years, the directors confidentially look forward to a really promising year.

Ozonair Engineering Ltd.

For 1954, the net profit after taxation is £6,771 (*£2,913*), and the dividend is again 8½% plus a bonus of 2½%.

C. A. Parsons and Co. Ltd.

Output last year was again a record for the company, and to meet the anticipated increasing demand, plans have been prepared for the erection of new shops covering over 300,000 sq ft which, equipped with modern machine tools and handling equipment, will cost over £3 millions, Sir Claude Gibb, the chairman, states. In this connection application has been made for consent to make and

Year to 31 Dec.	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	1,726,299	706,589	220	15	77/–	57/6
1951	2,513,829	1,067,452	167	13⅜*	58/6	37/6
1952	2,526,393	834,598	125	12½	55/6	43/–
1953	2,810,131	809,833	40	10⅝†	48/–	27/9
1954	3,603,818	1,474,844	79	10	60/6	38/1

*Plus 100% capital bonus.
†Plus 100% capital bonus.

use a railway connecting the north and south section of Heaton Works. An associated concern, Parolle Electrical Plant Co., Ltd., has taken part in the design of the Calder Hall nuclear power project, and as the result orders have been received and production is now well advanced for the special dual pressure turbo-generators and other equipment.

Rawlplug Co. Ltd.

A final dividend of 30% makes a total of 40% on the Ordinary capital which was doubled by the one-for-one free scrip issue last July. This compares with the equivalent of 30% for 1953 when 60% was paid on half the present capital. The new profit before tax is £380,591 (*£314,387*).

Wm. Sanders & Co. (Wednesbury) Ltd.

The obvious improvement in the trading position last year is reflected in the figures shown in our accompanying table. In the full accounts, stock in trade and work in progress at £49,482 is only just over 50% of the previous year's figure, but current assets total £159,319, compared with £139,687 at 31 Dec. 1953, due to the inclusion of £79,406 in respect

Year to 31 Dec.	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	50,545	19,036	46	40*	—	—
1951	40,848	12,329	31	25	3/5	2/6
1952	36,298	11,677	28	20	3/3	2/6
1953	26,150	7,096	17	15	2/9	2/–
1954	36,581	13,767	30	20	2/3	1/9

*Plus 200% capital bonus.

of a fire insurance claim. It is stated that capital commitments amount to £9,344 which includes restoration expenses arising from fire damage.

Telegraph Construction and Maintenance Co. Ltd.

A final dividend of 4½%, makes 8½% total. In the early part of last year, orders came in very slowly for the Cables Division, but in the latter part there was a substantial improvement, and the year ended with a combined order book at nearly an all-time record, Mr J. N. Dean, the chairman, states. Capital expenditure commitments now amount to £370,000, and this is being financed from existing sources. The Metals Division is now getting into full production, and the

Year to 31 Dec.	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	390,938	142,443	26	11	43/6	35/3
1951	525,076	166,306	32	10	47/1	38/–
1952	694,767	229,693	22	8⅓*	29/1	22/1
1953	618,719	223,337	24	8⅓	31/3	25/6
1954	596,281	223,897	23	8⅓	35/–	29/3

*Plus 33⅓% capital bonus.

Plastics Division has been very active indeed, further expansion being necessary. Expenditure on research amounted to nearly £84,000 last year, and £100,000 is allocated for the current period. Negotiations are proceeding for the purchase of a privately owned company engaged in the manufacture of products closely allied to those of T. C. & M. If these are successful, it will involve a substantial expenditure which, in addition to the considerable expansion of the submarine cable business, may make it necessary to consider an issue of shares.

Telephone Rentals Ltd.

Group profit for 1954 amounts to £349,290 (*£219,841*) after charging taxation, etc. The dividend is 12½% (*10%*) on the increased capital.

Dividends Declared

Holophane Ltd. Interim 10% (7½%).
Herbert Morris. Interim 5% tax free.

Sayings OF THE WEEK

"To all who have suffered from the denial of electric light and heat in the Borrowdale Valley, it is heartening to find that the opinion and voice of the sufferers has actually enabled, at long last, the Lakes Planning Board to accept the present proposals to carry electricity into the valleys . . ." H. W. B., writing to the *Manchester Guardian*.

"I don't believe that nuclear fission applied to electricity production can affect us materially for more years ahead than need unduly concern us now . . ." DR D. P. WELMAN, chairman, North Western Gas Board, at the British Gas staff Association conference.

"Many of our troubles are due to a lack of realisation of man's power to create wealth, which is growing every day. There are few who make such a contribution to this ability as the electrical industry . . ." LORD CHANDOS, at the E.D.A. luncheon.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

13 May—N. Ireland. Installation in shops, flats and maisonnettes on Anderson town site.—See 5 May issue.

13 May—Co. Sligo. Electrical services in Cregg Hse for Sisters of La Sagesse.—See 28 Apr. issue.

13 May—Wolverhampton T.C. Class A sodium and fluorescent lighting including columns, lanterns, control gear and time switches.—Advertised in 14 Apr. issue.

14 May—Consett (Dur) U.D.C. Installation in 193 council houses.—See 5 May issue.

14 May—Dartford T.C. Mercury vapour street lighting units on concrete and cast iron columns.—See 28 Apr. issue.

14 May—Manchester T.C. Lamps for Corpn Transport Dept.—See 5 May issue.

16 May—Co. Antrim. Hotel and catering equipment for kitchen at Portrush Technical school.—See 5 May issue.

16 May—Bentley-with-Arksey (Yorks) U.D.C. Installation in 19 bungalows at The Homestead.—See 5 May issue.

16 May—Keynsham U.D.C. Installation in 28 houses on Park West estate.—See 28 Apr. issue.

16 May—Neath (Glam). Lighting columns and illuminated traffic guardposts; sodium lanterns, cable boxes, control gear, etc., on Neath By-pass.—See 28 Apr. issue.

16 May—Rothesay T.C. Installation in new office accommodation.—See 5 May issue.

16 May—West Lothian. Installation in 50 houses in Manse Rd, Kirkliston.—See 5 May issue.

17 May—Whitley Bay T.C. Installation in 12 houses on Earsdon Grange estate, and 8 at Seaton Sluice.—See 5 May issue.

18 May—Carlisle T.C. Installation at Wilson secondary school, Workington.—See 28 Apr. issue.

18 May—Carlisle T.C. Installation in 57 houses.—See 5 May issue.

18 May—Dublin T.C. Electrically-driven sewage pumps for Clontarf station.—See 24 Feb. issue.

18 May—Co. Wicklow. Motors, switchgear, etc., for conversion to electric power at Ballinclare Quarry.—See 5 May issue.

18 May.—Renfrew T.C. Electrical work in erection of 394 houses at Kirklandneuk. Applications by above date to H. D. M. McCutcheon, town clerk, Town Clerk's Office.

19 May—Belfast T.C. Plant for injection of chlorine into circulating water of condensers and auxiliary coolers at Power Station West.—Advertised in 7 Apr. issue.

19 May—Edinburgh T.C. Bell system at Middleton Hse.—See 5 May issue.

20 May—Carshalton T.C. Supply and erection of 133 lighting columns along main roads. Engineer and Surveyor, Stone Court, The Grove.

20 May.—Durham. Electrical installation in Bowburn modern school and Durham school clinic. County Architect, Court Lane.

20 May—Edinburgh T.C. Installation at Calderglen nursery school.—See 5 May issue.

20 May—Middlesbrough T.C. Supply of electric lamps and unit dry cells, and concrete street lighting columns, in year from 1 July. Borough Engineer, Municipal Buildings.

21 May—Bexley T.C. Group A and B sodium street lighting units, and tungsten filament units.—See 5 May issue.

21 May—Ipswich T.C. Group A sodium lanterns, control gear, etc., group A tungsten lanterns and steel and concrete columns.—See 5 May issue.

23 May—Goole T.C. Electrical installation in erection of 33 houses in Western Rd and Charles Drive. Borough Surveyor, Municipal Offices. Deposit £2. 2s.

23 May—Stevenage U.D.C. Supply and erection of 75 concrete columns, lanterns and auxiliary equipment for group A lighting along about 2,900 yd of London Rd. Engineer and Surveyor, Council Offices, Orchard Rd.

23 May—West Riding. Rewiring of installation, phase 2, at Thorne grammar school. County Architect, Bishopgarth, Westfield Rd, Wakefield. Deposit £2. 2s. —Advertised in this issue.

23 May.—Wigan T. C. Electrical installation in various housing schemes. Borough and Water Engineer, Municipal Buildings, Hewlett St.

24 May—East Riding. Installation in Beverley, Molescroft school and Driffield school for girls.—See 21 Apr. issue.

25 May—Birmingham T.C. Street lighting equipment, including cast-iron and steel columns, lanterns, time switches, etc.—See 5 May issue.

25 May—Dublin. Electrical installation in new visiting hall at Grange-gorman Mental Hospital. Varming and Mulcahy, consulting engineers, 70 Merrion Sq. Deposit £5. 5s.

25 May—Manchester T.C. Installation at Smedley Rd secondary school, Cheetham. —Advertised in 5 May issue.

26 May—Belfast T.C. 11·8 kV and lower voltage transformers for Power Station West.—Advertised in 14 Apr. issue.

26 May—Belfast T.C. Extension to ash handling plant of Power Station West.—Advertised in 14 Apr. issue.

27 May—Heckmondwike U.D.C. Installation in 10 bungalows on Dale Lane estate.—See 28 Apr. issue.

27 May.—Sutherland. Electrical installation at Ross House Girls' Hostel, Dornoch, County Architect, E. W. Brannen, County Offices, Dornoch.

28 May—Todmorden T.C. Supply and erection of 92 140 W sodium lighting units along Rochdale Rd, and 86 85 W sodium units along Bacup Rd, on steel columns, and supply of polythene insulated and P.V.C. sheathed cable and galvanised steel tubing. Borough Engineer, Municipal Offices, Rise Lane. Deposit £2. 2s.—Advertised in this issue.

30 May.—Edinburgh T.C. Installation of new switchboard at Usher Hall; also electrical installation at Towerbank school. Separate contracts. City Architect, City Chambers.

31 May—Bentley-with-Arksey U.D.C. Supply and erection of lanterns, lamps, control gear, columns, underground cable for lighting about mile of Askern Rd Toll Bar. Engineer and Surveyor, Council Offices, Cooke St, Bentley. Deposit £2. 2s.—Advertised in this issue.

3 June—Belfast T.C. CO_2 fire fighting equipment at South Central substation. —Advertised in 28 Apr. issue.

6 June—Bushey U.D.C. Erection of 131 25 ft concrete columns, brackets, 140 W sodium vapour discharge lanterns, lamps, wiring, etc., along Elstree Rd and Aldenham Rd/Hertspring Lane. Engineer and Surveyor, Council Offices. Deposit £2. 2s. —Advertised in this issue.

6 June—Southgate B.C. Street lighting equipment under two contracts.—Advertised in 5 May issue.

7 June—Manchester T.C. Electrical installation in 8 flats at Brooklands and 248 dwellings at Peel Hall. Director of Housing, Town Hall.—Advertised in this issue.

13 June—N. Ireland. Installation in county intermediate school at Cloundagh, Portadown.—See 5 May issue.

13 June—West Riding. Maintenance of refrigerators in school kitchens throughout county. County Architect, Bishopgarth, Westfield Rd, Wakefield. Deposit £1. 1s.—Advertised in this issue.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources including an index of trade information with over 100,000 entries

A Selection from the 126 queries answered this week

"Rowlett" toasters, makers of? W.P.—Rowlett Eng. Co., Ltd., East Rd Works, Burnt Oak, Edgware, Middx.

Electrically-operated door locks, makers of? E.E.B.—W. C. Davey and Co., 180 Tottenham Court Rd, W.1; Lamlock Ltd., 163 Vivian Ave, Wembley, Middx.

"Stewart Shearmaster" clipper, address for? J.W.J.—Cooper-Stewart and Co., Ltd., Stewart Works, Works Rd, Letchworth, Herts.

"Roto-grill" infra-red griller with spit, suppliers of? A.S.—Allen Walters and Co., Ltd., 6a St. John's Hill, S.W.11.

Fluorescent fitting incorporating a 40 W cylindrical choke about 7 in. long and 1½ in. diameter, makers of? L.B.—Gordon and Smith, Sidmouth Works, Sidmouth Mews, Grays Inn Rd, W.C.1.

"Fitall" pencil-type elements, makers of? B.C.—S. I. Engel, 23/25 Kensington Park Rd, W.11.

"Donovan" starters, makers of? S.W.B. —Donovan Electrical Co., Ltd., 70/82 Granville St, Birmingham 1.

"Mixmaid" mixers, makers of? W.P.—Tide Electrical Co., Ltd., 34/36 High St, Southall, Middx.

9 July—Co. Louth. Supply and installation of electrically driven pumping and water filtration plant in supply system for villages of Louth, Mullacrew and Tallanstown. Consulting engineer, P. J. Tobin, 22 Eyre Sq, Galway. Deposit £5. 5s.
No date stated—Cumberland. Wiring at Bridekirk Church.—See 5 May issue.
No date stated—Durham. Installation at Stockton fire station and police houses at Seaham.—See 5 May issue.
No date stated—Sherburn (Dur). Applications invited for renewal and rewiring of electrical system at St Mary's Church. Details from S. Moody, 16 Grey Ave.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon House, Theobalds Rd, W.C.1, quoting reference.*

31 May—India. Govt. of Andhra's Dept. of Electricity, 20 Rutland Gate, Madras, invites tenders (Specif. A179) for two 7,500 kVA and six 5,000 kVA power transformers. B.o.T. (Ref.: ESB 9411/55).*
1 June—South Africa. Supply of a 50-line PAX type auto exchange unit initially equipped for 25 lines, and for master sets providing loud-speaking, key calling facilities. Tender C2. Stores Dept., S. African Railways, Johannesburg. B.o.T. (Ref.: ESB 9242/55).*
2 June—South Africa. Stores Dept. of S. African Railways invite tenders (C.9206) for supply of 10,000 6 in. disc type suspension indicators for 3,000 V d.c. overhead track equipment for electric traction. B.o.T. (Ref.: ESB 9384/55).*
2 June—U.S.A. Supply of two indoor metal-clad generator-voltage switchgear essemblies, four 75 kVA distribution transformers, and four 55 kW, 133 V, 415 A(cont) 0·32 ohm resistors, for Palisades Power Plant. U.S. Dept. of Interior, Bureau of Reclamation, Denver, Colorado. B.o.T. (Ref.: ESB 9651/55).*
6 June—India. Indoor and outdoor 11 kV equipment in respect of construction work of Koyna hydro-electric project at seven substations. Tender No. SPE 51 XVI/55-56. Director of Industries and Central Purchasing Officer, Old Custom Hse Yard, Fort, Bombay. B.o.T. (Ref.: ESB 9369/55).*
6 June—Syria. Supply of armoured lead cables required by Direction General du Service d'Installation des Telephones at Damascus. B.o.T. (Ref.: ESB 9226/55).*
9 June—New Zealand. G.P.O. at Wellington invites tenders (No. P. and T. 150/7891) for supply of 100 miles cable, quad, polythene insulated and P.V.C. sheathed. B.o.T. (Ref.: ESB 9512/55).*
16 June—India. Supply of total of 8,100 yd of multicore control cable. Tender PTC/2905/55-56/A. Bombay Electric Supply and Transport Undertaking, Bombay. B.o.T. (Ref.: ESB 9367/55).*
16 June—India. Supply of total of 21,600 yd of combined communication and control cables and accessories. Tender No. PTC/2906/55-56/A. Controller of Stores, Bombay Electric Supply and Transport Undertaking, Bombay. B.o.T. (Ref.: ESB 9366/55).*
20 June—Australia. Following for Wallerawang power station: two indoor type natural circulation water tube boilers; piping installations; and four electrically driven boiler feed pumps. Contract No. 450. Electricity Commission of N.S.W., Box 5257, G.P.O., Sydney. B.o.T. (Ref.: ESB 8849/55).*
23 June—India. Manufacture, supply, erection, etc., of hydro-electric turbo-alternator generating sets and allied indoor switchgear with all accessories for Periyar power house. Govt. of Madras' Dept. of Electricity, 157 Mount Rd. B.o.T. (Ref.: ESB 8458/55).*
27 June—Australia. Supply, erection, etc., at Wallerawang power station of two 60 MW turbo-alternator sets and ancillary equipment for State Electricity Commission of N.S.W., Kelvin Hse, Box 5257, G.P.O., Sydney. Specif No. 451. B.o.T. (Ref.: ESB 8850/55).*
28 June—New Zealand. Supply of one 50,000 kVA 11/220 kV transformer bank and spare unit for Wairakei power station, for State Hydro-Electric Dept. Documents available from N.Z. Govt. Offices in London.
29 June—India. Supply of one 11–132 kV 55 MVA power transformer for Panchet Hill hydro-electric power station. Tenders (No. Ed. 712-3) invited by Damodar Valley Corpn., Anderson Hse, Alipore, Calcutta. B.o.T. (Ref.: ESB 8996/55).*
30 June—India. Seven 10,000 kVA 22,000/6,500 V power transformers with automatic on load voltage regulating gear and accessories; seven tap change control panels for voltage regulating gear including line drop compensator, parallel control switches and relays; and set of spares and tools; required by Bombay Electric Supply and Transport Undertaking for receiving stations at Esplanade, Mahalutmi, Kingway and Mahim. Tender No. PTC 2903/55-56/A. B.o.T. (Ref.: ESB 9368/55).*
5 July—New Zealand. Wellington City Corporation's Transport Dept. invites tenders (contract T.5) for 33 trolleybuses of forward-control type, for one-man operation and with full-fronted all metal bodies. B.o.T. (Ref.: ESB 7144/55).*
6 July—South Africa. Supply of two 30,000/30,000 kVA 3-phase dual ratio transformers with fittings and accessories with electrical control arrangements and spares. City of Cape Town, Electricity Dept., Electricity Hse, Strand St. Specification No. 1830/1955 D. B.o.T. (Ref.: ESB 8755/55).*
11 July—Iraq. Supply and erection at Zakho of three 75 kW diesel driven alternator sets with switchboard, control panels, small wiring, etc., etc. Tender No. 111. Directorate General of Municipalities, Baghdad. B.o.T. (Ref.: ESB 8853/55).*
12 July—Egypt. Erection at ATF power station, Mahmoudia, of extra 15,000 kW turbo-generator unit, with steam boilers, transformers, electrical apparatus, etc. Documents at £E.10 from Egyptian Embassy, 75 S. Audley St, London, W.1.
17 July—India. Tenders (No. PTC 2904/55-56/A) invited by Bombay Electric Supply and Transport Undertaking, for supply of and erection of 22 kV and 6·6 kV switchgear and accessories for main receiving stations at Esplanade and Mahalutim. B.o.T. (Ref.: ESB 9365/55).*
19 July—Iraq. Supply and erection of two 250 kW alternator sets with switchgear, atmospheric coolers and overhead crane; supply only of a 250 kW and a 90 kW alternators to replace existing d.c. generators; and supply and erection of 500 kVA transformers at Baqouba. Directorate-General of Municipalities, Baghdad. B.o.T. (Ref.: ESB 9482/55).*

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, 10 May

	£ per ton	Weekly change £	Price last year £
COPPER, standard class A (settlement)	305	+2	244
„ (3 months)	291	−1	239½
R.S.T. (Rhodesian Selection Trust) group price*	280	—	—
LEAD, refined pig, min. 99·97% purity (cash)	102½	−1	95½
„ (3 months)	102¾	−¾	93½
TIN, refined, min. 99·75% purity (settlement)	712	+2	720
„ (3 months)	714½	+1½	717½
ALUMINIUM, ingots 99·99·5%	163	—	156
ZINC, virgin, min. 98% purity (cash)	89½	+¾	80½
„ (3 months)	88½	+¾	79½
RUBBER No. 1, RSS, spot (per lb.)	27½d.	+⅛d.	18⅛d.
„ c.i.f. basis, ports, July (per lb.)	26½d.	+⅛d.	18 1/16 d
ARMOURING:			
Galv. Steel Wire (0·104 in.)	52½	—	52
Mild Steel Tape (0·014 in.)	41½	—	40½

(*Fixed price c.i.f., U.K. for 30 days from 9 May to "consumers willing to instil a degree of stability into the resale price".)

Contracts Placed

Bournemouth T.C. Installation of lighting points in council houses, Southern Electricity Board, £2,010.
Glasgow T.C. Supply of 28 traction batteries, Tudor Accumulator Co., Ltd., £15,219; ditto of 600 steel lighting poles for Castlemilk housing scheme, Stewarts and Lloyds Ltd., £15,375.
London. Two electric lifts at County Hall for L.C.C., Express Lift Co., Ltd., £25,156.
Rayleigh. Supply and installation of 33 kV cable between Eastern Board substation and Traction substation for B.R., Johnson and Phillips Ltd.

Trade Notes

Forthcoming change. Telegraph Construction and Maintenance Co.'s lease at 22 Old Broad St, E.C.2, expires shortly, but the company has obtained two floors in Mercury House, Theobalds Rd, W.C.1.
Change of Name. The title of the Wolseley Sheep Shearing Machine Co., Ltd., has been changed to Wolseley Engineering Ltd.
Agents. Henry Turner & Co., who have just moved to 58 Upper Tooting Rd, S.W.17, have been appointed sole selling agents in the U.K. for "Mikron" machine tools.
New Depot. On 16 May, W. T. Henley's Telegraph Works Co., Ltd., are opening a new stores depot at Craven St, Leicester. Telephone No. 23653. The store will be under the control of Mr F. Bull, Henley's Nottingham branch manager, and Mr B. H. Sprake will be the local representative.

BUSINESS PROSPECTS

Home

Alloa. Plans approved for 100 houses on Inglewood site. Also Scottish Special Housing Assoc. to build 102 houses at Post Hill, Sanchie, for T.C.

Altrincham T.C. Application may be made to borrow £4,300 for modernisation of distribution system to council houses on Oldfield Brow estate.

Barrhead. Glencree Bonding Co., Ltd., 44 West George St, Glasgow, to erect hotel in town centre. Quantity surveyors are Smith Mackay and Simpson, 6 India St, Glasgow.

Berkhamsted U.D.C. Erection of 44 flats in four blocks. R. E. Hulse, Engineer and Surveyor, Civic Centre.

Bexhill T.C. C. H. and E. F. Dyer, have plans for showroom, etc., at Mount Idol, Minfield Rd. Office, workshop, etc., planned by Parker and Cole Ltd. in Little Common Rd.

Brighton T.C. Erection of 14 flats at Hollingbury. Borough Engineer and Surveyor, 26-30 King's Rd.

Bromley. W. Smith and Co. (Engrs) Ltd. are planning a factory. Architect is K. P. Roberts, 21 Woodstock St, London, W.1.

Chingford T.C. Erection of eight houses and nine flats on Chingford Mount Rd site. Borough Engineer, Town Hall.

Croydon. Offices to be built at 119 High St, for Pitchers Ltd., 57 Ashburton Rd, N.7. Cost will be about £85,000.

Dewsbury T.C. All trades in phase 1 extensions at Technical and Art College. Borough Architect and Buildings Surveyor, Town Hall.

Co. Down. New factory to be built at Donaghadee for Cyril Lord Ltd., textile makers of 51 Fountain St, Manchester. Architect is W. H. McAllister, 16 Waring St, Belfast.

Durham. £14,000 to be spent on renewing electrical installation at Neville's Cross training college, and £550 on renewal of system at Horden Colliery junior boys' school. It is also proposed to install electricity at Willington C.E. (Controlled) school at £400 cost; and carry out alterations to wiring at Stockton Technical Inst. at cost of £3,250.

East Kilbride. Development Corpn. to build printing works on trading estate for Waterlow and Sons Ltd. Cost estimated at £1m.

Exeter. Application to be made to borrow £970,000 for erection of new council offices in Topsham Rd.

Farnworth T.C. Construction of 70 dwellings on Plodder Lane South site. Borough Engineer and Surveyor, Town Hall.

Halifax T.C. Construction of Mixenden community centre. Borough Engineer, Crossley St.

Hendon T.C. Richardson and Davis, 57 Queen Anne St, W.1, likely to be quantity surveyors in respect of extensions to town hall. Estimated cost £54,800.

Heywood T.C. Construction of 20 houses in Wolsey St, 14 in Peel Lane, and 7 bungalows in Farm St. A. Middleton, Borough Engineer and Surveyor, Municipal Buildings.

Hinckley (Leic) U.D.C. Tenders may soon be invited for erection of 58 dwellings on Sketchley Hill estate.

Holland C.C. to erect new county secondary school at Holbeach.

Jarrow. G. C. Young of 12 Grange Rd West, is architect for Baptist church and hall in Perth Ave.

Kidderminster T.C. Plans for housing development on Summerhill estate for J. and R. Perrin Ltd., Sutton Rd, being considered.

Kincardine. Plans approved for erection of 50 houses at Cove Bay.

Leicester. Site in Humberstone Rd to be cleared for 200,000 sq ft office block and warehouse for Freeman, Hardy and Willis Ltd.

Liverpool. Rope works in Mill Lane of Hugh Lewis and Sons to be rebuilt after fire. Plans by A. G. Harndean, 62 Dale St. Also, plans approved for 8 shops with 12 flats and public hall to seat 200 on Deysbrook Lane estate.

Llangefni (Anglesey). Erection of 30,000 sq ft factory being considered by Development Commission, 6a Deans Yard, Westminster, S.W.1.

London. R. Ward and Partners, 29 Chesham Place, Belgrave Sq, S.W.1, are architects for paint factory proposed at 35 Southgate Rd, N.1, at cost of about £72,000.

Maidstone T.C. Construction of 38 houses on Shepway Farm estate. Borough Surveyor, Palace Ave.

Mansfield T.C. Tenders may be invited shortly for erection of 100 houses.

Middleton T.C. Erection of 68 houses and 36 flats on Hollin estate. G. Syddall, Borough Architect, Town Hall.

Morpeth. Work expected to start soon on new church at St. Aidan's, Stobhill. Architects are W. B. Edwards and Partners, Eldon Place, Newcastle.

North Riding. Quantity surveyors for proposed Skelton and Brotton, and Malton, county modern schools, are Barrett, Son and Partners, 50 Pall Mall, London, W.1, and A. W. West, 32 Coney St, York, respectively.

Northamptonshire. Former Franklins Hotel in Guildhall Rd to be converted into council offices. Fifty houses to be built this year on Burcote Rd estate, Towcester. Northampton R.D.C. to erect 65 houses, village hall, 2 shops and bungalows at Billing. County primary school to be built on Grange estate, Kettering.

Northumberland. Approval granted for erection of secondary schools at Pontelland, Morpeth, N. Sunderland, Alnwick and Tweedmouth in 1955-56 building programme. Also revised scheme approved for construction of C.D. training centre at Morpeth which is estimated to cost £55,999.

Penzance T.C. Revised plans approved for 56 flats in St. Clare St.

Rowley Regis T.C. Erection of 34 houses on Tividale Hall estate. Architect, Municipal Buildings, Old Hill.

Skegness U.D.C. Planning approval sought for first stage of layout of Sundial estate, providing for 62 houses, four shops and flats, etc.

Southend. C. F. Marshall and Son Ltd., Essex Works, propose to erect new factory.

Stocksbridge U.D.C. Erection of 69 houses on Stubbin Farm estate, Deepcar. Council's consultants, Husband and Co., 388 Glossop Rd, Sheffield.

Stoke Newington T.C. Plans in hand for erection of four-storey block of 20 flats in Burma Rd when site has been purchased.

Stourbridge T.C. Construction of 36 houses and 8 flats on Wollaston Farm estate. G. N. Maynard, Borough Engineer and Surveyor, Council House.

Sudbury (Suff) T.C. Layout plans approved for erection of further 107 dwellings on Woodhall estate.

Taunton R.D.C. It is proposed to erect 31 houses at Monkton Heathfield.

Thorne (Yorks R.D.C. Thirty houses to be erected on S. Common estate.

Wallasey T.C. Construction of 87 houses and 12 flats on Leasowe estate. Borough Architect, Town Hall.

Walthamstow. Extension at No. 1 factory in Argall Ave proposed by S. E. Porter and Sons Ltd.

Wolverhampton. Architect for factory at Wombourn for John Whitehouse and Son Ltd., Park St, South, is W. H. Page, 2 Tettenhall Rd.

Overseas

Australia. Mr Alfred Lewis, managing director of Leo Rogaly and Lewis Pty., Ltd., 33 Bathurst St, Sydney, will be visiting U.K. next month and wants to obtain agencies for machine tools and electrical goods either on commission basis or purchase on own account. He will also be interested in buying items like the following, branded and packed under their own trade mark: filament lamps and fluorescent tubes, flash lights and electrical appliances and accessories. Whilst in Britain Mr Lewis' address will be c/o Treximport Ltd., 7 Cavendish Place, London, W.1.

Belgium. B.I.B. (Belgium-Ireland-Britain) S.A., 21 rue Defacqz, Brussels, wish to obtain representations of U.K. makers of electronic equipment for control of production in factories, TV spare parts and aerials, etc., electronic surgical equipment, and small electronic equipment for industrial purposes.

Canada. Mr F. W. Sawatzky, president of Ambassador Sales, 531 Marion St, St Boniface, Manitoba, wants to contact U.K. manufacturers of elevators and escalators.

Egypt. Tubular steel lighting standards, lantern and brackets with fuse and terminal boxes required by Committee on American Aid, Ministry of Finance and Economy, Cairo, under Foreign Operations Admin. Procurement for Egypt.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Electramaid. 737,410. Class 7. Washing machines and non-domestic floor polishing machines. Vacuum Cleaners and Electrical Supplies Ltd., 20/22 Gipsy Hill, S.E.19.

Wellux. 738,113. Class 7. Generators for domestic lighting purposes. Welland Eng. Co., Ltd., Water Lane, Spalding, Lincs.

Cromalog. B721,922. Class 9. Nickel-chromium alloy resistance wire for use in making heating elements. A. C. Scott and Co., Ltd., Cromaloy Hse, City Rd, Manchester 15.

Univick. 725,138. Class 9. Arc welding apparatus and electrodes. Metropolitan-Vickers Electrical Co., Ltd., 1/3 St. Paul's Churchyard, E.C.3.

Power-Seal. B735,349. Class 9. Dry batteries and plates. Oldham and Son Ltd., 36 Hyde Rd, Denton, near Manchester.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, W.C.2.

Home Heating Ltd. Electrical or mechanical engineers, etc. Nom. cap.: £1,000. Dirs.: not named. Subs.: F. J. Lynch, 22 Allenby Rd, Forest Hill, S.E.23, and J. T. W. Downs, 99 Littleheath Rd, Selsdon, Surrey.

H. W. Forrest (Transformers) Ltd. 349 Haslucks Green Rd, Shirley, nr, Birmingham. Manufacturers and repairers of and dealers in artificial lighting apparatus, electrical plant, etc. Nom. cap.: £1,000. Dirs.: H. W. Forrest and Margaret G. Forrest.

Diemould Service Co., Ltd., 6 Raymond Bldgs, Gray's Inn, W.C.1. General mechanical, electrical and precision engineers, tool makers, etc. Nom. cap.: £2,000. Dirs.: N. Heywood, G. N. Gee, and A. L. Slater.

R. G. Knight (Bromley) Ltd., 11 Sundridge Rd, Bromley, Kent. Electrical, gas, sanitary, mining, mechanical and general engineers, etc. Nom. cap.: £2,000. Dirs.: K. M. Knight and Winifred M. Knight.

Trevor-Johnstone Development Co., Ltd., 169 Sloane St, S.W.1. Manufacturers of and dealers in apparatus, appliances, machinery, mechanical and electrical goods of all kinds, etc. Nom. cap.: £100. Dirs.: G. Trevor-Johnstone and Joan W. Trevor-Johnstone.

T.I.E. (Installations) Ltd., Aerial Hse, Tylagwyn, Nantgarw, Glam. To install, develop and operate radio and television relay equipment; radio, television, telephonic and telegraphic engineers, etc. Nom. cap.: £100. Dirs.: D. R. Lewis and M. H. Bolderson.

Bestshades Ltd., 26/7 Conduit St, W.1. Manufacturers of and dealers in electric shades, ornaments, signs and fittings, etc. Nom. cap.: £1,000. Dirs.: D. Joseph and C. A. H. Blattman.

Tom Finney (Auto) Ltd. Auto electrical engineers and contractors, etc. Nom. cap.: £2,000. Dirs.: T. Finney, 27 Atherton Rd, Fulwood, Preston; J. Finney, 15 Devonshire Rd, Preston; J. K. Horton and J. H. Ingham.

A. R. Shepherd and Son Ltd., 364 Brockley Rd, S.E.4. To take over business of radio, television and electrical service engineers carried on as "A. R. Shepherd" at Brockley Rd, S.E.4. Nom. cap.: £1,000. Dirs.: A. R. Shepherd and Mrs K. Shepherd.

Polas Ltd. Dealers in and exporters and importers of refrigerators and refrigerating plant, electrical and domestic appliances, etc. Nom. cap.: £100. Dirs.: not named. Sub.: Miss P. J. Slocombe, 77 Hewlett Rd, Cheltenham, and W. A. A'Bear, 1 Lynworth Terr, Blacksmiths Lane, Prestbury, Cheltenham.

C. Waller and Sons Ltd., 220 Brownhill Rd, Catford, S.E.6. To take over business of insulation engineers and merchants carried on at Catford, S.E.6, by C. Waller and Sons, manufacturers of and dealers in block and processed mica and micanite, and all other insulating materials, etc. Nom. cap.: £15,000. Dir.: C. D. Waller.

Mast Electrical Ltd., 54 Queensway, W.2. Manufacturers, buyers and sellers of electronic equipment, toys and other electrical and mechanical devices, etc. Nom. cap.: £100. Dir.: E. P. Wade-Brown.

Electro (Wednesbury) Ltd., 79 Holyhead Rd, Wednesbury, Staffs. Electrical and electronic engineers and contractors, etc. Nom. cap.: £1,000. Dirs.: Mrs E. L. Pugh, A. S. Pugh, S. Turner and M. J. Fowell.

Compacta Ltd., 225 High Rd, Ilford, Essex. Mechanical, heating, ventilating, electrical and electronic, optical, consulting and precision engineers, etc. Nom. cap.: £100. Dirs.: Mrs O. A. Redhead and Mrs D. E. E. Redhead.

R. Galbraith (Exhall) Ltd., The White Bldg., Wilsons Lane, Exhall, nr. Coventry. Manufacturers of and dealers in dynamos, motors, armatures, magnetos, etc. Nom. cap.: £1,000. Dirs.: R. G. Galbraith, Mabel N. Galbraith, and G. H. Price.

Automatic Signs Ltd., 113 Chatham St, S.E.17. Manufacturers of and dealers in neon and electric signs, etc. Nom. cap.: £1,000. Dirs.: J. B. Andrews and R. T. Bennett.

Gazette Announcements

COMPANIES ACTS

Rutland Electric Lamp Co., Ltd., Nivalight (1928) Ltd. and **Meteor Electric Lamp Co., Ltd.** Creditors of all these companies which are being voluntarily wound-up are asked to send particulars to J. A. Deed, Farleigh Hse, Lawrence Lane, Cheapside, London, E.C.2, the liquidator in respect of all three by 20 May. Resolutions for voluntary winding-up passed at meetings on 21 Apr.

Lance of Llandudno Ltd. E. K. Evans of Midland Bank Chambers, Mostyn St, Llandudno, has been appointed liquidator by company and creditors.

Eckington Electric Supply Co., Ltd. E. R. Birley of 17 Gluman Gate, Chesterfield, has been appointed liquidator by members in place of James Gadsby, deceased.

South Essex Electrical Installations Ltd. Meeting of creditors will be held at 642-4 London Rd, Southend, on 24 May at 12 noon.

Barolite Ltd. D. Morgan, of 100 Park St, London, W.1, has been appointed liquidator with committee of inspection.

H. V. Colman and Co. (Electrical Contractors) Ltd. Petition for winding-up presented and directed to be heard before County Court, Newton St, Birmingham, on 20 June. Interested parties should contact Price, Atkins and Price, solicitors, 71 Temple Row, Birmingham by 18 June.

Keen Refrigeration Co., Ltd. Meetings of members and creditors will take place at 100 Park St, W.1, on 10 June at 12 noon and 12.15 p.m. resp. to receive liquidator's report.

Partnership Dissolved

Holmes and Watts. Partnership between Charles F. Holmes and James W. Watts, electrical contractors trading under above name at 8 Barforth Rd, Peckham, London, S.E.15, dissolved as from 7 Mar.

BANKRUPTCY ACTS

Receiving Order

Wandsworth. Albert A. Barnes, plumber and electrician, trading at 61 Oxford Rd, Exeter. Receiving order dated 28 Apr.

Appointment of Trustee

Plymouth. Leonard C. Sampson and Ernest C. Tubb, trading as Electro Radio Stores at Fore St, Guninslake, Cornwall. Trustee is H. Evans, C.A., 39 St. James St, London, S.W.1.

Release of Trustees

London. Gilbert L. Searle, electrical engineer trading at 309 Portobello Rd, W.10. Trustee was F. H. Langmaid, Official Receiver, Bankruptcy Buildings, Carey St, W.C.2.

Croydon. William L. Kirby, trading as Borough Electric Co. at Dornberg Works, Dornberg Rd, Blackheath. M. G. Hacker, CERT. ACC., of 18 Maddox St, London, W.1, was trustee.

MEETINGS TO NOTE

THURSDAY, 12 MAY

I.E.E. (London). Discussion on "Image Intensification in Radiology," W. J. Oosterkamp and G. M. Ardran. Savoy Place, W.C.2, 5.30 p.m.

FRIDAY, 13 MAY

I.E.E. (Bristol Students). Annual meeting. Three short papers. Electricity Hse, Colston Ave, 7 p.m.

E.T.C.T.A. (London). General meeting, preceded by supper, at Feathers Hotel, Westminster, 6 p.m.

SUNDAY, 15 MAY

E.T.U. Annual Policy Conference at Worthing. Continues until Wednesday, 18 May.

MONDAY, 16 MAY

I.E.E. (London Students). Annual meeting. President's address on "Effect of Atomic Energy on Generation of Power." Savoy Place, W.C.2, 6.30 p.m.

IPSWICH ELECTRICAL ASSOC. Annual meeting at Electric Hse, 7.30 p.m.

TUESDAY, 17 MAY

I.E.E. (London Education). Questions night at Savoy Place, W.C.2, 6 p.m.

ELECTRICAL INDUSTRIES CLUB. Monthly luncheon at Connaught Rooms, Great Queen St, W.C.2.

E.I.B.A. (Sussex). Annual meeting at Seeboard Offices, Castle Sq, Brighton, 5.30 p.m.

WEDNESDAY, 18 MAY

I.E.E. (London Students). "Supply of Electricity in the London Area," D. B. Irving. Savoy Place, W.C.2, 5.30 p.m.

BRITISH INSTN. OF RADIO ENGRS. (London). "Development of Underwater TV Camera," D. R. Coleman, D. A. Allanson and B. A. Horlock. School of Hygiene, Keppel St, W.C.1, 6.30 p.m.

A.S.E.E. (Manchester). Annual meeting at Engineers' Club, Albert Sq, 7 p.m.

A.S.E.E. (Southampton). "Employer's Liability," R. Hughes. Polygon Hotel, 8.15 p.m.

A.S.E.E. (S.W. London). Selected American films of electrical interest. Guild Hse, 32 Worple Rd, Wimbledon, 7.15 p.m.

THURSDAY, 19 MAY

I.E.E. (London). Annual meeting. Followed at 6.30 p.m. by "Human Relations in Industry," Lord Citrine. Savoy Place, W.C.2.

I.E.E. (Irish). Annual meeting at 59 Merrion Sq, Dublin.

ROYAL SOC. OF ARTS. "Scientific Research in India." Viscount Waverley. Society is at John Adam St, W.C.2, 5.15 p.m.

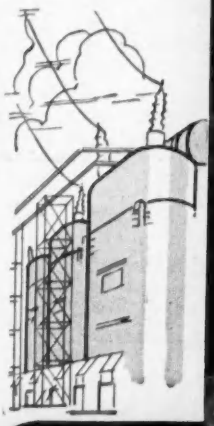
FRIDAY, 20 MAY

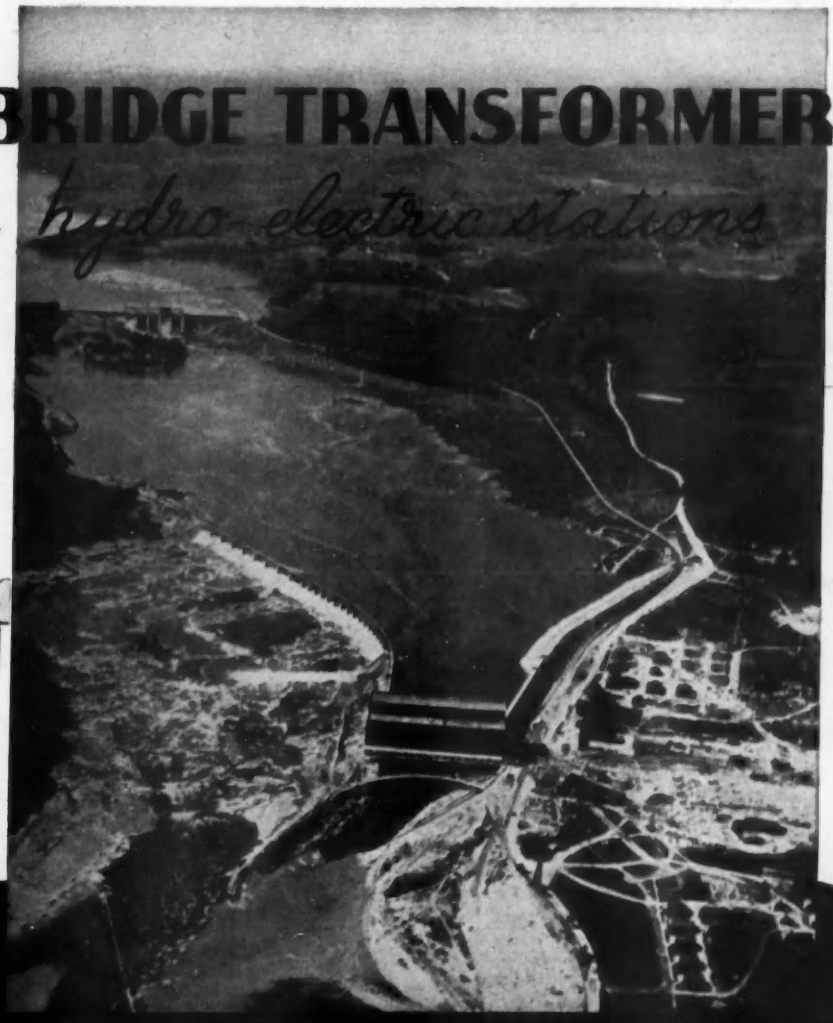
I.E.E. (Western). Summer meeting at Carlyon Bay Hotel, St. Austell, until 23 May.

A.S.E.E. (Watford). "Industrial Psychology," A. Angles. Clarendon Hotel, 8 p.m.

HACKBRIDGE TRANSFORMERS

for hydro-electric stations





THE Hackbridge and Hewittic Electric Co. Ltd. has a long and extensive experience in the manufacture of water cooled and other types of Transformers, up to the largest sizes, for hydro-electric power distribution.

HACKBRIDGE Transformers have established an unrivalled reputation for *reliable service* in world-wide hydro-electric installations, with operating conditions ranging from the tropical heat of East Africa to the extreme cold of Northern Canada.

HACKBRIDGE AND HEWITTIC ELECTRIC CO., LIMITED
WALTON-ON-THAMES · SURREY · ENGLAND

Telephone: Walton-on-Thames 760 (8 lines) · *Telegrams: "Electric, Walton-on-Thames"*

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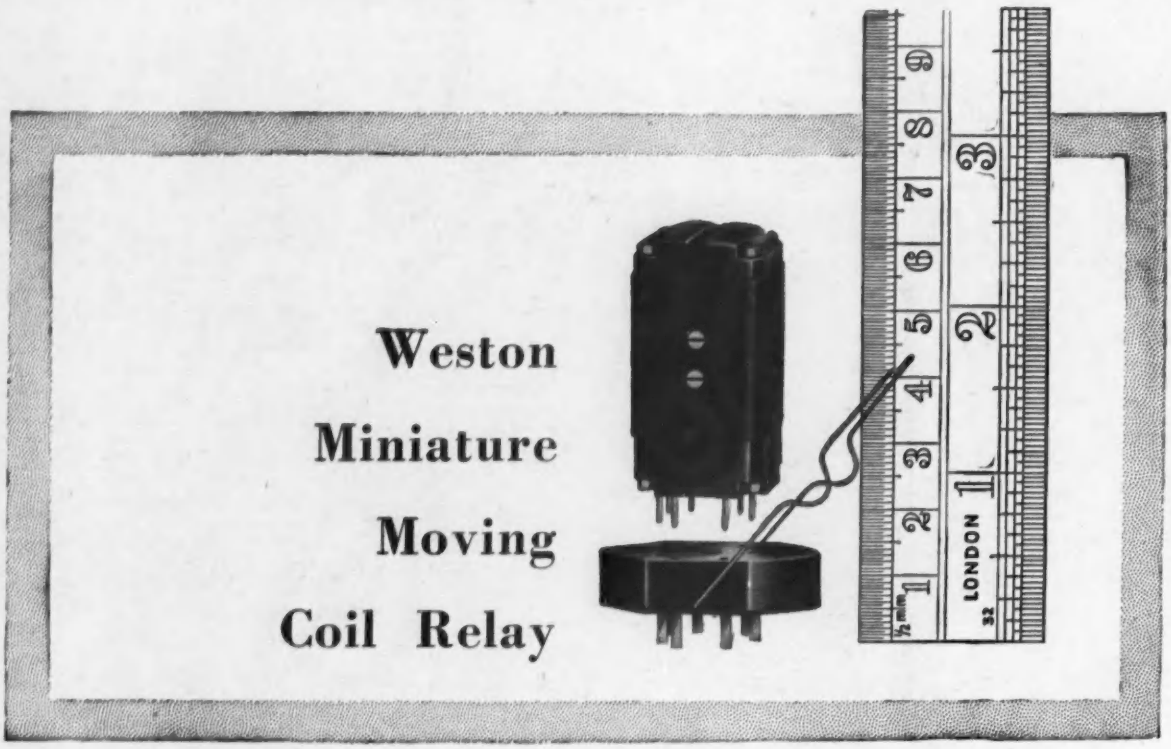

The "Weston" Model S.115 Miniature Moving Coil Relay functions as a sensitive "on-off" current switch, and will operate on a power input of only 5 microwatts. Generally the relay is supplied with a centre stable moving contact, but a biased version which affords a single break, or a break followed by a make, is also available. The moving coil can be provided with two windings which offer considerable scope in circuitry. The relay has a seven pin base and is supplied with a separate chassis or panel mounting socket with retaining clip : mounting position is unimportant. Size $1\frac{1}{2}''$ x $\frac{3}{4}''$ x $2\frac{1}{4}''$, weight $1\frac{3}{4}$ oz. only. List No. W.46 gives further particulars and is available on request, but these relays give best service wher they are specially designed to suit the circuit in which they are to be used, and we shall be delighted to co-operate on receipt of the pertinent information.

Other WESTON relays

MODEL S54. A relay of extreme sensitivity (size 4-1/5" x 3-1/5"). The high torque developed by the moving system ensures positive contact pressure. Leaflet — List No. W.45 gives details.

MODEL S124. A sensitive relay (size 2-3/16" x 2-3/16") with magnetic hold-on contacts having a higher rating than the other models. Leaflet — List No. W.43 gives details.

SANGAMO WESTON LIMITED

ENFIELD, MIDDLESEX · TEL: ENField 3434 (6 lines) & 1242 (6 lines) GRAMS: SANWEST, ENFIELD

Scottish Factory: Port Glasgow, Renfrewshire. Port Glasgow 41151

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CLASSIFIED ADVERTISEMENTS

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 32s. 6d. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

TENDERS INVITED

COUNTY COUNCIL OF THE WEST RIDING OF YORKSHIRE

SCHOOL MEALS SERVICE—
MAINTENANCE OF REFRIGERATORS

TENDERS are invited for the full comprehensive maintenance of refrigerators in School Kitchens throughout the Administrative County of the West Riding of Yorkshire. The Contract will be under the provisions of the County Council's Standing Orders in relation to contracts and will be for a period of five years in the first instance. A specification and Form of Tender setting out details of the scheme may be obtained from the County Architect, Bishopgarth, Westfield Rd, Wakefield, on payment of a deposit of £1. 1s., which will be returned on receipt of a bona fide tender. Applications to tender must be received not later than 16 May, 1955, and cheques should be made payable to the West Riding Treasurer and crossed "and Co."

Sealed Tenders must be addressed to me, the undersigned, and received at Room 3, County Hall, Wakefield, not later than 10 a.m. on Monday, 13 June, 1955.

BERNARD KENYON,
Clerk of the County Council.
(R 753)

COUNTY COUNCIL OF THE WEST RIDING OF YORKSHIRE

TENDERS are invited for the rewiring of the electrical installation, phase 11, at Thorne Grammar School.

Specification, drawings and Conditions of Tender may be obtained from the County Architect, Bishopgarth, Westfield Rd, Wakefield, on payment of a deposit of £2. 2s., which will be returned on receipt of a bona-fide tender. Cheques should be made payable to the West Riding Treasurer and crossed "and Co."

Sealed Tenders must be addressed to me, the undersigned, and received at Room 3, County Hall, Wakefield, not later than 10 a.m. on Monday, 23 May, 1955.

BERNARD KENYON,
Clerk of the County Council.
(R 754)

CITY OF MANCHESTER
Housing Committee

TENDERS are invited for Electrical Installations on the following contracts:
Contract 157N—Brooklands—8 Flats.

Contract 225—Peel Hall Extension—248 Houses, Cottage Flats, and Aged Persons' Dwellings.

Tender forms and schedules may be obtained from the Director of Housing, Town Hall, Manchester 2, and must be returned in a sealed official envelope addressed to the Chairman of the Housing Committee, to be received at the office of the Town Clerk not later than noon on Tuesday, 7 June, 1955.

PHILIP B. DINGLE,
Town Clerk.
(R 787)

BUSHEY URBAN DISTRICT COUNCIL

IMPROVED LIGHTING SCHEMES
Aldenham Rd/Hartspring Lane (B.462), and Elstree Rd (A. 411)

TENDERS are invited for the excavation of trial holes, the erection of 131 (provisional) No. reinforced concrete lighting columns (25 ft mounting height) with appropriate brackets, and the installation of 140 W sodium vapour discharge lanterns complete with lamps, wiring, and all ancillary electrical equipment.

Forms of Tender, Specification, and Bill of Quantities, can be obtained, on payment of a deposit of Two Guineas, from the Engineer and Surveyor, Council Offices, Bushey, Herts. Cheques to be made payable to "Bushey Urban District Council," and upon receipt of a bona fide tender and the return of all documents, the deposit will be refunded.

Tenders must be delivered to the undersigned not later than 12 noon on Monday, 6 June, 1955, in plain sealed envelope endorsed "Improved Lighting Schemes."

The Council does not bind itself to accept the lowest or any tender, and the acceptance of a tender will be subject to the approval of the Ministry of Transport.

C. G. EVERATT,
Clerk of the Council.

Council Offices,
Rudolph Rd,
Bushey, Herts.
2 May, 1955. (R 727)

BOROUGH OF TODMORDEN

TO MANUFACTURERS OF STREET LIGHTING EQUIPMENT, ERECTION CONTRACTORS AND ELECTRIC CABLE AND GALVANISED STEEL TUBE MANUFACTURERS

PROPOSED SODIUM DISCHARGE LIGHTING ON BACUP RD. A.681, AND ROCHDALE RD. A.6033.

TENDERS are invited for the following work and/or materials. The supply, erection and putting into service of 92-140 W sodium lighting units on Rochdale Road and 86-85 W sodium lighting units on Bacup Rd. Lighting units will be carried by steel columns and brackets. Tenders are also required for the supply of polythene insulated and P.V.C. sheathed cable and galvanised steel tubing.

Tenders may be submitted as follows:

(*a*) Supply of Electrical and Optical Equipment.
(*b*) Supply and Erection of Steel Columns and Brackets together with the fitting and wiring of equipment offered under (*a*) above.
(*c*) Supply and Erection of Steel Columns and Brackets together with the fitting and wiring of equipment offered by another firm.
(*d*) The supply only of polythene insulated and P.V.C. sheathed cable.
(*e*) The supply only of galvanised steel tube.

Firms may tender for each section or combination of sections.

General Conditions of Contract, Specifications, Bills of Quantities and Forms of Tender may be obtained from the Borough Engineer, Municipal Offices, Rise Lane, Todmorden. A deposit of £2. 2s. will be

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required from firms applying for these documents for any or all of Sections *a*, *b* and *c*, but no deposit is required for Section *d* and *e*. Plans may be inspected at the Engineer's Office at all reasonable times.

Tenders in a plain sealed envelope endorsed "Sodium Lighting" should be forwarded to me not later than first post on Saturday, 28 May, 1955

The Council do not bind themselves to accept the lowest or any tender.

J. D. MOYS,
Town Clerk.

Municipal Offices,
Todmorden.
5 May, 1955. (R 756)

BENTLEY-WITH-ARKSEY URBAN DISTRICT COUNCIL

SODIUM DISCHARGE LIGHTING
ASKERN ROAD TOLL BAR

TENDERS are invited for the lighting of about 1 mile of Class I road, as follows:

(*a*) Supply of lanterns, lamps and control gear.
(*b*) Supply and erection of columns, fitting and wiring of equipment.
(*c*) Provision of underground cable.

Tenders may be submitted for any or all of the above work, each of which will form a separate contract.

Drawings, Specification, Bills of Quantities and Form of Tender may be obtained from, and the Conditions of Contract inspected at, the office of the Engineer and Surveyor at the address below, on deposit of two guineas, returnable only on receipt of a bona fide tender and the return of the documents.

Sealed tenders in envelopes not bearing any mark indicating the name of the sender, and endorsed "Street Lighting, Askern Rd," must reach the undersigned not later than Tuesday, 31 May, 1955.

The Council does not bind itself to accept the lowest or any tender.

W. H. CARLILE,
Clerk of the Council.

Council Offices,
Cooke St, Bentley,
Nr. Doncaster, Yorks. (R 728)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18-64, or a woman aged 18-59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

PORT OF LONDON AUTHORITY

THE Port of London Authority invite applications for the position of ASSISTANT ENGINEER (Electrical) at a salary (inclusive of Pay Supplement) of £995 rising by annual increments to £1,356 per annum.

Candidates, who must be British subjects and Corporate Members of the Institution of Electrical Engineers, should have served a recognised apprenticeship with one of the major electrical manufacturing firms and should have experience in the specification, installation, operation and maintenance of the electrical equipment of a dock or harbour undertaking or heavy industrial organisation, including H.V. and L.V. distribution systems, rectifying plant, A.C. and D.C. cranes and pumping plant, large lighting schemes and V.H.F. radio-telephony. Preference will be given to candidates not over 40 years of age.

The successful applicant will be required to become a member of the Port Authority's contributory superannuation scheme. In certain cases existing pensionable service is transferable.

Application forms may be obtained from the Establishment Officer, Port of London Authority, Trinity Sq, London, E.C.3.

E. S. BIRCH,
Secretary.
(R 730)

CENTRAL ELECTRICITY AUTHORITY
East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

SECTION LEADER (CIVIL) GENERATION (CONSTRUCTION) DIV. H.Q.

Vacancy No. 65/55/E.T.

Candidates should be capable of taking charge of a Civil Section in the Generation (Construction) Drawing Office, and should have experience in the design and detail of heavy reinforced concrete structures, heavy foundations, retaining walls, culverts, etc.

Preference will be given to candidates holding qualifications equivalent to Corporate Membership of the Institution of Civil Engineers.

Salary in accordance with Schedule D, Grade 3 (£860 x £20—£960 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 26 May, 1955.

FOURTH ASSISTANT ENGINEER TO DIVISIONAL CHIEF CHEMIST

Vacancy No. 68/55/E.T.

Previous power station experience is not essential but candidates should preferably have had previous industrial experience in one or other of the following fields:

Air and water pollution, water treatment, fuel testing, lubrication, paint technology, inorganic analysis, or metallurgy and should hold the Ordinary National Certificate in Chemistry (or equivalent qualification).

The position will be located in the first instance at Staythorpe Power Station near Newark, and ultimately in Nottingham.

Salary will be in accordance with Class AX/DX, Grade 6 (£600/£785 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 23 May, 1955.

SECOND ASSISTANT ENGINEER (ELECTRICAL) GENERATION (CONSTRUCTION) DEPARTMENT

Vacancy No. 72/55/E.T.

Preference will be given to applicants who hold a degree in Electrical Engineering, are Corporate Members of the Institution of Electrical Engineers, or possess other equivalent qualifications.

They should have had experience in the design and installation of switchgear, transformers and cables up to 33 kV and other electrical equipment associated with modern power stations.

Experience in the preparation of specifications and estimates and preparing reports on tenders will be a recommendation.

Salary will be within Schedule C, Class AX/DX, Grade 2 (£950/£1,165 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 23 May, 1955.

THIRD ASSISTANT ENGINEER (ELECTRICAL) GENERATION (CONSTRUCTION)

Vacancy No. 73/55/E.T.

Applicants should have had a fundamental training in electrical engineering, including workshops, and should preferably have had experience in the manufacture, erection and maintenance and operation of electrical plant as installed in modern Power Stations. Preference will be given to candidates who possess a Degree or are Graduate Members of the Institution of Electrical Engineers.

Salary will be within Schedule C, Class AX/DX, Grade 4 (£750/£950 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 23 May, 1955.

These appointments will be pensionable within the terms and provisions of the Central Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form A.E.6/ACT which may be obtained from the Divisional Establishments Officer, Central Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote Vacancy No.

L. F. JEFFREY,
Divisional Controller.
(R 714)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments, which are superannuable and subject to medical examination:

1. SECTION ENGINEER to be based at Birkenhead in the North Wirral District of the Board's No. 3 Sub-Area. Salary £790/£850 per annum. (N.J.B. G/7).

Applicants must have had experience in the construction, operation, and maintenance of overhead and underground systems up to and including 33 kV, and should preferably have the technical qualifications to enable them to become Chartered Electrical Engineers.

2. ASSISTANT (ESTATES AND WAYLEAVES) at the Board's No. 3 Sub-Area Headquarters, Chester. Salary £585/£645 per annum. (N.J.C. Grade 3).

The appointment is primarily concerned with negotiations for substation sites and rights of way, and applicants should have a practical knowledge of land acquisition procedure, including statutory and other consents.

For posts 1 and 2, applications on forms obtainable by written request from the Manager, No. 3 Sub-Area, Electricity Hse, Newgate St, Chester, should be completed and returned not later than 23 May, 1955.

3. SECTION ENGINEER to be based on Blaenau Ffestiniog in the Board's No. 4 Sub-Area. Salary £715/£760 per annum. (N.J.B. E/7.)

Applicants should preferably have the technical qualifications to enable them to become Chartered Electrical Engineers, and should have experience in all branches of work associated with design, construction, and operation of E.H.T., H.T., and L.T. overhead and underground distribution systems, including indoor and outdoor substation equipment.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity Hse, Rhostyllen, near Wrexham. Closing date: 23 May, 1955. (R 751)

NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF
THIRD ASSISTANT ENGINEER,
TECHNICAL AND RESEARCH SECTION
CHIEF ENGINEER'S DEPARTMENT,
AREA BOARD HEADQUARTERS,
MANCHESTER

DUTIES will include a study of the problems arising on a large distribution system. A wide experience of distribution methods is desirable, together with a good knowledge of protective gear. Ability to prepare concise reports will be an advantage.

Technical qualifications should be up to H.N.C. standard in Electrical Engineering.

Salary Scale: £750/£975 per annum, Class AX/EX Grade 4, N.J.B. Conditions.

NOTE.—Applicants who applied in response to the previous advertisement of this post need not re-apply.

Applications to Establishment Officer, The North Western Electricity Board, Cheetwood Rd, Manchester 8, by 21 May, 1955. (R 761)

THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY
Foulness, Essex

requires LEADING DRAUGHTSMEN to prepare schemes and design layouts and drawings for a wide variety of light/medium electrical and mechanical equipment and/or to lead a small team of draughtsmen. Applicants should have served a recognised engineering apprenticeship or have had equivalent workshop experience, possess a Higher National Certificate or equivalent qualification and have had suitable drawing office experience. Salary £710/£830 per annum. The successful applicant will be required to join the Authority's contributory superannuation scheme.

Requests for application forms by Post Card to Senior Recruitment Officer, A.W.R.E., Aldermaston, Berks. Quote ref. 642/WGE/49. (R 729)

CENTRAL ELECTRICITY AUTHORITY
Eastern Division

APPLICATIONS are invited for the following appointments at Goldington Generating Station (near Bedford):

FIRST ASSISTANT STATION CHEMIST

Salary Class G, Grade 9, £715 x £15—£760 per annum, rising eventually to Class H.

Applicants should have a minimum qualification of Higher National Certificate in Chemistry or be appropriately advanced in a course of study leading to a recognised qualification in chemistry.

Applicants should be experienced in chemical analysis and the testing of Generating Station materials, and knowledge of ion-exchange plant, boiler fouling and corrosion problems would be of advantage.

GENERAL ASSISTANT ENGINEER

Salary Class G, Grade 15, £475 x £15—£520 per annum or Grade 14, £515 x £15—£560 per annum, depending upon duties and responsibilities, rising eventually to Class H.

Duties include assisting in the Electrical Control Room and experience in the technical operation of electrical, boiler house and turbine house plant, testing, etc., in a Generating Station and provide a suitable basis for promotion to higher technical grades.

Previous experience in a Generating Station and/or technical training to the standard of the Ordinary National Certificate or its equivalent will be of advantage.

Applications stating age, details of qualifications and experience should be addressed to the Controller, Central Electricity Authority, Eastern Division, Northmet Hse, Southgate, N.14, to arrive not later than 28 May, 1955.

W. N. C. CLINCH,
Controller.
(R 759)

SOUTH EASTERN ELECTRICITY BOARD

CARTOGRAPHER (MALE OR FEMALE)—KINGSTON AND DISTRICT

SALARY within the range Male £190/£495 per annum and Female £162/£420 per annum according to age and experience, plus London Weighting. Superannuable. Applicants should have a sound general education. Experience of general drawing office routine an advantage.

Applications, naming 2 referees, on forms from D. C. Thomson, B.SC., M.I.E.E., Kingston and District Manager, SEEBoard, 22 Claremont Rd, Surbiton, Surrey, by 25 May, 1955.

ELECTRICIAN—CRAWLEY DISTRICT

Wages 4s. 1d. per hour for 44-hour, 5-day week under N.J.I.C. Agreement. Experience of refrigerator maintenance and repairs an advantage.

Applications, naming 2 referees, to F. A. Avery, A.I.E.E., District Manager, SEEBoard, 55 High St, Crawley, by 25 May, 1955.

GENERAL ASSISTANT DISTRICT ENGINEER—PURLEY DISTRICT

Salary £515/£560 per annum plus London Weighting under N.J.B. Class F, Grade 13. Superannuable. Applicants should hold the Higher National Certificate in Electrical Engineering or its equivalent and have practical training and experience in general distribution work on systems up to 11 kV.

Applications on forms from J. McAlister, B.SC., A.M.I.E.E., District Manager, SEEBoard, Electric House, High St, Purley, Surrey, by 25 May.

2ND ASSISTANT DISTRICT ENGINEER—PURLEY DISTRICT

Salary £755/£800 per annum plus London Weighting under N.J.B. Class F, Grade 7. Superannuable. Applicants should hold the Higher National Certificate in Electrical Engineering or its equivalent and have practical experience in general distribution work up to 11 kV on underground and overhead systems.

Applications on forms from J. McAlister, B.SC., A.M.I.E.E., District Manager, SEEBoard, Electric House, High St, Purley, Surrey, by 25 May.

A. L. BURNELL,
Secretary.
(R 772)

CENTRAL ELECTRICITY AUTHORITY
South Wales Division

Vacancy No. 50/55

APPLICATIONS are invited for the following superannuable N.J.B. appointments in the Generation (Operation) Department, Divisional Headquarters:

(1) THIRD ASSISTANT ENGINEER (TESTING, EFFICIENCY AND COMBUSTION).

Salary: AX/DX 4 — £750/£950 per annum.

Applicants should preferably possess qualifications leading to Corporate Membership of the Institution of Electrical Engineers and/or the Institution of Mechanical Engineers.

Experience in carrying out Acceptance Tests on generating plant; routine plant tests; investigation of operational difficulties and improving plant performance. Standardisation and calibration of test instruments, compilation of test reports.

(2) FOURTH ASSISTANT ENGINEER (TESTING, EFFICIENCY AND COMBUSTION).

Salary: AX/DX.6—£600 to £785 per annum.

Candidates should hold Higher National Certificate or equivalent qualifications and have experience of power station operation.

Previous experience of power plant testing advantageous.

Application forms obtainable from Secretary, South Wales Division, Central Electricity Authority, Twyn-y-Fedwen Rd, Gabalfa, Cardiff, to be returned by 28 May, 1955. (R 778)

NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:

Area Board Headquarters

THIRD ASSISTANT ENGINEER, Planning and Development Section, Carliol House, Newcastle upon Tyne, to assist with engineering details of contracts for 66 kV and lower voltage substation equipment, in particular switchgear, transformers and control equipment. Preference given to applicants having a working knowledge of control panel diagrams of connections.

Salary, Schedule "C," Grade 4—£750/£950. N.J.B. conditions of service.

Wear Sub-Area

FOURTH ASSISTANT ENGINEER, Sub-Area Commercial Officer's Staff, Sunderland. Duties will include rural development and the application of electricity to farming. Graduate Membership I.E.E. and/or H.N.C. desirable.

Salary, Schedule "A," Class L, Grade 13—£715/£760. N.J.B. conditions of service.

Applications stating age, qualifications and experience to be received by the Secretary, Establishments, The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. (R 771)

LONDON ELECTRICITY BOARD
Engineering Draughtsman

APPLICATIONS are invited for the above position in the Design and Planning Branch of the Northern Sub-Area.

Applicants should preferably have had experience in mains recording with a public utility authority, preferably with an Electricity Board, and be able to obtain particulars on site and compile accurate permanent records. Some knowledge of electrical plant layout, building construction and simple reinforced concrete structures would be an additional advantage.

The post is graded under Schedule D of the National Joint Board agreement as Grade 6—£535. 10s./£661. 10s. per annum, inclusive of London Allowance.

Application forms obtainable from Personnel Officer, 46/7 New Broad St, E.C.2, to be returned completed by 28 May, 1955. Please enclose addressed envelope and quote ref.: V/1965/T on envelope and all correspondence. (R 789)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following vacancies:

Essex Sub-Area

SUB-AREA HEADQUARTERS, NR. BRENTWOOD

THIRD ASSISTANT ENGINEER CONTROL (SHIFT DUTIES)

79/55.R

Candidates should have had a wide experience in the operation and control of a large high voltage distribution system, be fully conversant with the Central Electricity Safety Rules (Distribution) and be capable of taking charge of all system operation, during their shift, in the Essex Sub-Area.

Salary in accordance with Class K, Grade 10, of the National Joint Board Agreement commencing at £790 plus London Allowance.

Apply to the Manager, Essex Sub-Area, Eastern Electricity Board, "Millfield," Bentley, near Brentwood, Essex.

Norfolk Sub-Area

SUB-AREA HEADQUARTERS, NORWICH

(*a*) THIRD ASSISTANT ENGINEER (PLANNING AND DEVELOPMENT)

85/55.N

(*b*) FOURTH ASSISTANT ENGINEER (PLANNING AND DEVELOPMENT)

86/55.N

(*c*) TWO FOURTH ASSISTANT ENGINEERS (CONSTRUCTION)

84/55.N

Candidates for these appointments should have had a sound technical training and for appointment (*a*) experience in the design of substations up to and including 33 kV. For appointment (*b*) candidates should be experienced in the planning of distribution schemes in a rural area and for appointment (*c*) a good experience of construction work up to and including 33 kV is required.

Salary for these appointments in accordance with Class J of the National Joint Board Agreement as follows:

(*a*) Grade 10, commencing at £755.

(*b*) and (*c*) Grade 13, commencing at £635.

Apply to the Manager, Norfolk Sub-Area, Eastern Electricity Board, 4 Duke St, Norwich, Norfolk.

KING'S LYNN AND WESTERN DISTRICT

(*a*) THIRD ASSISTANT ENGINEER

82/55.N

(*b*) FOURTH ASSISTANT ENGINEER

83/55.N

Candidates should have had a sound technical training and for appointment (*a*) experience in the field, particularly on operation and maintenance work. For appointment (*b*) candidates should be experienced in construction, operation and maintenance duties.

Salary in accordance with Class E of the National Joint Board Agreement as follows:

(*a*) Grade 9, commencing at £635.

(*b*) Grade 11, commencing at £555.

Apply to the District Manager, Eastern Electricity Board, Gaywood Bridge, King's Lynn, Norfolk.

Northmet Sub-Area

SUB-AREA HEADQUARTERS, LONDON, N.14

(*a*) SENIOR DRAUGHTSMAN

80/55.R

(*b*) ENGINEERING DRAUGHTSMAN

81/55.R

(*c*) FOURTH ASSISTANT ENGINEER (OPERATION AND MAINTENANCE)

89/55.R

Candidates for (*a*) should have had experience of Building and Civil Engineering work for substations, service centres, workshops, offices, etc. The successful candidate will be required to supervise staff engaged on the preparation of drawings for 33 kV substations, should be capable of the design of simple reinforced concrete structures and be able to carry out site surveys. A knowledge of the use of a theodolite would be an advantage.

For (*b*) candidates should have had a good technical training and experience in the preparation of plans and detailed drawings of Building and Civil Engineering work, including substations, service centres, workshops, offices, etc.

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For (*c*) candidates should have had a good general and technical education and possess the Higher National Certificate or equivalent qualifications. Previous experience in the carrying out of switching operations, testing and commissioning of protective gear and fault investigation in the field on mains and plant will be an advantage.

Salary for these appointments in accordance with the National Joint Board Agreement as follows:

(*a*) Grade 5, Schedule D, £640/£740, plus London Allowance.

(*b*) Grade 6, Schedule D, £510/£630, plus London Allowance.

(*c*) Class M, Grade 13, commencing at £755, plus London Allowance.

Apply to the Manager, Northmet Sub-Area, Eastern Electricity Board, Northmet House, Southgate, London, N.14.

FOURTH ASSISTANT ENGINEERS

88/55.R

Required in the following localities:

(*a*) Barnet District (Ref. 550)

(*b*) Edmonton District (Ref. 551)

(*c*) Stevenage District (Ref. 552)

Candidates should have had a sound technical training and experience in the construction, operation and maintenance of H.V. and L.V. distribution systems, including substations.

Salary in accordance with Grade 11 of the National Joint Board Agreement as follows:

(*a*) Class E, commencing at £555, plus London Allowance.

(*b*) Class F, commencing at £595, plus London Allowance.

(*c*) Class F, commencing at £595.

Apply to the District Manager, Eastern Electricity Board, at the following addresses:

(*a*) 7c High St, Barnet, Herts.

(*b*) 305 Fore St, Edmonton, London, N.9.

(*c*) 38 High St, Stevenage, Herts.

Future salaries and conditions of service for all these appointments will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications, by letter, stating age, education, qualifications and experience, with details of present appointment and salary, should be submitted to the Manager concerned within fourteen days of the appearance of this advertisement. (R 780)

CENTRAL ELECTRICITY AUTHORITY
South Eastern Division

BRIGHTON "B" POWER STATION

ASSISTANT ENGINEER (Mechanical Planning) Class J, Grade 11, £715/£760 per annum. Applicants should have had practical experience of Power Station layout, operation, maintenance and in the control of labour. Successful applicant will be responsible for the planning of mechanical plant maintenance and associated labour.

CROYDON "B" POWER STATION

ASSISTANT ENGINEER (Works Office Co-ordination) Class J, Grade 7, £900/£975 per annum, plus 5% London allowance. The position requires a person having foresight with an analytical mind, coupled with initiative to co-ordinate the operation and maintenance activities of a modern Power Station. Applicants should have experience of both these activities and preferably possess membership of either the Institution of Mechanical or Electrical Engineers.

N.J.B. Conditions of Service for both these positions. Applications, giving details of education, present position, experience, etc., should be sent to the Station Superintendent at *either* Brighton Power Station, Portslade-by-Sea, Sussex *or* Croydon "B" Power Station, Beddington Farm Rd, Croydon, Surrey, according to the location of vacancy to arrive by 21 May. (R 786)

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEER (PLANNING)

SWINDON District, No. 2 (Newbury) Sub-Area. Salary N.J.B. Grade 11, Class F (£595/£640 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist the Planning Engineer in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks, and to undertake standby duties if required. Suitable technical qualifications and field planning experience are necessary.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him in envelopes suitably endorsed not later than 27 May, 1955.

AGRICULTURAL REPRESENTATIVE

Basingstoke District, No. 3 (Portsmouth) Sub-Area. Salary N.J.C. Grade 3 (£585/£645 per annum). N.J.C. Conditions of Service.

Candidates should possess a General Certificate of Education or its equivalent and have a sound knowledge of the applications of electricity in Agriculture and Horticulture, be capable of preparing estimates for small wiring installations and equipment; conducting negotiations and obtaining new business. Ability to give talks to agricultural organisations will be an advantage.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him in envelopes suitably endorsed not later than 27 May, 1955.

GENERAL ASSISTANT ENGINEER

Melksham District, No. 2 (Newbury) Sub-Area. Salary N.J.B. Class F, Grade 14 (£475/£520 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist with distribution including minor construction work and general maintenance. Applicants should have received Technical training equivalent at least to O.N.C. standard.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him in envelopes suitably endorsed not later than 27 May, 1955.

The successful candidates for the above appointments will be required to contribute to the C.E.A. and Area Boards' Superannuation Scheme, if eligible. (R 775)

COUNTY BOROUGH OF WEST HAM

Education Committee

WEST HAM COLLEGE OF TECHNOLOGY, ROMFORD ROAD, STRATFORD, E.15

Principal: E. A. Rudge, PH.D., M.SC., A.M.I.CHEM.E.

REQUIRED ASSISTANT LECTURER Grade B, in the Electrical Engineering Department. Candidates must have University degree, industrial experience and be able to teach in field of Electrical Power and Machines.

Salary: Burnham Technical Scale (London).

Forms of application and particulars obtainable from the Principal.

R. OPENSHAW,
Chief Education Officer.
(R 774)

NOTTINGHAMSHIRE COUNTY COUNCIL

County Architect's Department

APPOINTMENT OF ELECTRICAL ENGINEERS

APPLICATIONS are invited for the following appointments:

ASSISTANT ELECTRICAL ENGINEERS. Salary according to the A.P.T. Special Scale, £650 x £25 to maximum £775.

Applicants should be corporate or graduate members of the Institution of Electrical Engineers and should have had at least five years' experience (which may include the period spent in theoretical training).

Forms of application may be obtained from Donald Gibson, County Architect, County Hall, Trent Bridge, Nottingham, to whom they should be returned not later than 25 May, 1955.

A. R. DAVIS,
Clerk of the County Council.
(R 762)

CENTRAL ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for the following positions:

ASSISTANT ENGINEER (EFFICIENCY) MARCHWOOD GENERATING STATION

S/13/660

Applicants should have had considerable experience in the operation and testing of plant installed in a large modern generating station using pulverised or oil fuel, and possess qualifications leading to corporate membership of a recognised professional institution.

Salary N.J.B., Class K.7, £975 x £25—£1,050.

PROGRESS ENGINEER
POOLE EXTENSION SITE
GENERATION CONSTRUCTION DEPARTMENT

S/13/659

The work will consist of checking and recording the progress of plant erection and the forwarding of contractors' materials to site. Applicants should preferably have had a general engineering shop and drawing office training, and should be studying for a recognised technical qualification (mechanical and/or electrical). Site or shipyard experience covering the erection of boilers and turbines, pumps and switchgear, etc., will be an advantage.

Salary N.J.B., AX/CX, Grade 6, £600/£765.

Special application forms, obtainable from P. D. A. Oliver, Divisional Secretary, High St. Portsmouth, should be returned by 25 May, 1955. Please quote reference E.T. (R 776)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

Shropshire and Herefordshire Sub-Area

SECOND ASSISTANT ENGINEER (PLANNING)

Applicants should have a wide technical and practical experience of planning major systems up to and including 66 kV, both overhead and underground, technical calculations, protective systems, etc. Preference will be given to candidates with appropriate technical qualifications. Salary £790/£850 per annum (N.J.B. Grade G.7). (The classification for the year 1954/55 is based on units sales of 295 million units.)

Apply, in writing, within fourteen days, stating age, qualifications and experience to Mr W. Winwood, Sub-Area Manager, Midlands Electricity Board, Spring Gardens, Ditherington, Shrewsbury.

Wolverhampton and District Sub-Area

GENERAL ASSISTANT DISTRICT ENGINEER, CANNOCK DISTRICT

Applicants should have had a sound technical training and experience in the construction, operation and maintenance of overhead and underground systems. Technical qualifications desirable. Salary £515/£560 per annum (N.J.B. Grade E.12).

Apply, in writing, within fourteen days, stating age, qualifications and experience to Mr F. J. Elliott, Sub-Area Manager, Midlands Electricity Board, 83 Darlington St, Wolverhampton.

A. STEPHENS,
Secretary.
(R 777)

MANCHESTER CORPORATION TRANSPORT DEPARTMENT

TECHNICAL ASSISTANTS required for Chief Engineer's Section, viz.:

Electrical—Salary National Scale APT.11, £600/£725 per annum, minimum qualifications Higher National Certificate and preferably graduate membership of the Institution of Electrical Engineers.

Electrical and Mechanical — National Scale APT.1, £500/£580 and APT.2, £560/£640 per annum. Candidates should possess the Higher National Certificate and have some practical training.

Details of the duties and forms of application obtainable from the General Manager, Corporation Transport Department, 55 Piccadilly, Manchester 1, to whom the completed form, with the names of two referees should be returned not later than 30 May, 1955. Canvassing is prohibited. (R 732)

SOUTH WESTERN ELECTRICITY BOARD

1. SECOND ASSISTANT DISTRICT ENGINEER (STREET LIGHTING) PLYMOUTH

SALARY N.J.B. Class F, Grade 7, £755/£800 per annum.

Duties involve organising a Street Lighting Department dealing with the planning and construction of new schemes and the maintenance of all existing street lighting in the City of Plymouth and surrounding areas covering some 10,000 existing lighting points.

A wide knowledge of modern street lighting practice and organisation of a Street Lighting Department is required. Corporate or graduate membership of the I.E.E. would be an advantage.

2. FOURTH ASSISTANT ENGINEER—AREA BOARD HEADQUARTERS—BRISTOL

Salary N.J.B. Class AX Grade 6—£600/£725 per annum—with progression to Class CX—£765.

Applicants should be experienced in survey and planning work connected with all classes of overhead lines and underground mains up to 33 kV and in the control of men. Experience in the negotiation of wayleaves is also required. Possession of H.N.C. is desirable.

The appointed centre is Bristol, but the successful applicant will be required to travel extensively throughout the Board's area. Travelling and subsistence allowances will be paid when working away from the appointed centre.

3. SENIOR DRAUGHTSMAN, HEAD OFFICE, BRISTOL

Salary within Schedule D, Grade 5—£640 x £20 to £740 per annum—of the N.J.B. Agreement.

Candidates should have had good experience in a Mains Drawing Office, and be capable of laying out and estimating new work for overhead and underground HV and LV schemes, and preparing accompanying drawings. They should also be familiar with Substation layout, both indoor and outdoor, and be able to carry out modifications to equipment drawings and prepare designs of equipment from engineering notes and data. Experience in survey work is essential. Possession of the H.N.C. an advantage.

4. ENGINEERING DRAUGHTSMAN, HEAD OFFICE, BRISTOL

Salary N.J.B. Schedule, Grade 6—£510/£630 per annum.

Duties include preparation of engineering drawings, substation site and layout plans, mains and statistical records. Knowledge of overhead line design essential, and surveying experience would be an advantage.

Application forms obtainable for post 1 from the District Manager, Armada St, Plymouth, and for posts 2, 3, and 4, from the Assistant Secretary (Establishments) Electricity House, Bristol 1, should be returned by 24 May, 1955. (R 768)

CENTRAL ELECTRICITY AUTHORITY

South Wales Division

Vacancy No. 49/55

APPLICATIONS are invited for the superannuable N.J.B. appointment of FOURTH ASSISTANT ENGINEER, Measurement Section, Technical Department at Divisional Headquarters.

Salary: AX/DX6—£600/£785 per annum, annum.

H.N.C. or equivalent qualification desirable.

The work of this Section involves precision measurements by means of potentiometer equipment, integrating meters, indicating instruments and electronic devices. Additional duties concern the acceptance testing of new generators, efficiency testing of existing plant, the initiation of signals for remote indication and much new development.

Applicants having an interest in such work may obtain application forms from the Secretary, Central Electricity Authority, South Wales Division, Twyn-y-Fedwen Rd, Gabalfa, Cardiff, to be returned by 25 May, 1955. (R 779)

CENTRAL ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. for posts (*a*) and Corporate Membership for posts (*b*) an advantage.

(*b*) STATION SUPERINTENDENT
BOW GENERATING STATION
Vacancy No. 55/332

Applicants should have had a wide experience of Power Station operation, maintenance and administration, and should have a lively sense of responsibility in Management/Employee relations. Salary—N.J.M. and Higher Executive scale 1= £1,200/£1,350 per annum.

(*b*) STATION SUPERINTENDENT
WEST HAM GENERATING STATION
Vacancy No. 55/333

Applicants should have had a wide experience of Power Station operation, maintenance and administration and should have a lively sense of responsibility in Management/Employee relations. Salary—N.J.M. and Higher Executive scale 2= £1,350/£1,500 per annum.

(*a*) ASSISTANT MAINTENANCE ENGINEER (ELECTRICAL) WEST HAM GENERATING STATION
Vacancy No. 55/334

Applicants should have had a sound practical and technical training and previous experience of Power Station electrical maintenance is desirable. Preference will be given to Engineers in possession of qualifications leading to Corporate Membership of the Institution of Electrical Engineers. Salary—Class H, Grade 9= £792. 15s./£840 per annum.

(*a*) ASSISTANT MAINTENANCE ENGINEER (MECHANICAL) WEST HAM GENERATING STATION
Vacancy No. 55/335

Applicants should have had a sound practical and technical training and previous experience of Power Station mechanical maintenance is desirable. Preference will be given to Engineers in possession of qualifications leading to Corporate Membership of the Institution of Mechanical Engineers. Salary—Class H, Grade 9= £792. 15s./£840 per annum.

(*a*) SHIFT CHARGE ENGINEER, GLAUCUS STREET, POPLAR GENERATING STATION
Vacancy No. 55/336

Sound technical training with practical experience of operation and control of Boilers, Turbines and Switchgear. Salary—Class D, Grade 7=£708. 15s. per annum.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, Central Electricity Authority, P.O. Box 136, Generation House, Great Portland St, W.1, and be received within 14 days of this advertisement. (R 770)

CENTRAL ELECTRICITY AUTHORITY

South Western Division

TECHNICAL STAFF VACANCIES—PORTISHEAD "B" POWER STATION.

(*a*) MAINTENANCE ENGINEER (Electrical)) N.J.B. J.6, £975/£1,050.
(*b*) SHIFT CHARGE ENGINEERS N.J.B. J.7, £900/£975.
(*c*) ASSISTANT SHIFT CHARGE ENGINEERS N.J.B. J.9, £790/£850.

Superannuation.

Applicants for (*a*) should have had wide experience in maintenance of modern generating plant. Associate Membership of appropriate Engineering Institution or equivalent desirable.

For (*b*) should have had considerable experience in a modern generating station. Graduate or Corporate Membership of a recognised Engineering Institution or equivalent desirable.

For (*c*) should have had sound technical training, practical operating experience in a modern generating station.

Applications on Form A.E.6/ACT obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol, 8, should be completed and returned by 23 May, 1955. (R 757)

YORKSHIRE ELECTRICITY BOARD

No. 5 (Wakefield) Sub-Area

Wakefield District

DISTRICT SENIOR CLERK

THE successful applicant will be responsible for the organisation of District clerical services, including the control of staff, consumer and other records, statistics, correspondence and general secretarial and accountancy duties.

Salary—N.J.C. Grade 7, £870/£30/£960 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Rd, Wakefield, not later than 26 May, 1955.

No. 1 (Bradford) Sub-Area

Otley District

THIRD ASSISTANT DISTRICT ENGINEER

Applicants should have passed the Graduate Membership Examination of the Institution of Electrical Engineers or hold equivalent technical qualifications and have experience in construction, operation and maintenance of high voltage systems, underground cables, overhead lines, substations and medium and low voltage networks.

Candidates must be prepared to reside within the District and to undertake standby duties.

Salary—N.J.B. Class E, Grade 9, £635/£15/£680 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45-53, Sunbridge Rd, Bradford, not later than 26 May, 1955.

HEAD OFFICE

Chief Engineer's Department

ENGINEERING DRAUGHTSMAN

Applicants should have had a practical training and possess the Ordinary National Certificate in Electrical Engineering. Knowledge of the layout of 33 kV and 66 kV Substations (outdoor and indoor) will be an advantage.

Salary—N.J.B. Schedule D, Grade 6, £510/£20/£630 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Secretary, Head Office, Yorkshire Electricity Board, Scarcroft, Leeds, not later than 26 May, 1955. (R 758)

CENTRAL ELECTRICITY AUTHORITY

East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

FOURTH ASSISTANT ENGINEER TO DIVISIONAL CHIEF CHEMIST
Vacancy No. 68/55/ET

Previous power station experience is not essential but candidates should preferably have had previous industrial experience in one or other of the following fields:

Air and water pollution, water treatment, fuel testing, lubrication, paint technology, inorganic analysis, or metallurgy and should hold the Ordinary National Certificate in Chemistry (or equivalent qualification).

The position will be located in the first instance at Staythorpe Power Sation near Newark, and ultimately in Nottingham.

Salary will be in accordance with Class AX/DX Grade 6 (£600/£785 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 23 May, 1955.

SECOND ASSISTANT ENGINEER (ELECTRICAL) GENERATION (CONSTRUCTION) DEPARTMENT
Vacancy No. 72/55/ET

Preference will be given to applicants who hold a degree in Electrical Engineering, are Corporate Members of the Institution of Electrical Engineers, or possess other equivalent qualifications.

They should have had experience in the

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design and installation of switchgear, transformers and cables up to 33 kV and other electrical equipment associated with modern power stations.

Experience in the preparation of specifications and estimates and preparing reports on tenders will be a recommendation.

Salary will be within Schedule C, Class AX/DX, Grade 2 (£950/£1,165 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 23 May, 1955.

THIRD ASSISTANT ENGINEER (ELECTRICAL) GENERATION (CONSTRUCTION) DEPARTMENT
Vacancy No. 73/55/ET

Applicants should have had a fundamental training in electrical engineering, including workshops, and should preferably have had experience in the manufacture, erection and maintenance and operation of electrical plant as installed in modern Power Stations. Preference will be given to candidates who possess a Degree or are Graduate Members of the Institution of Electrical Engineers.

Salary will be within Schedule C, Class AX/DX, Grade 4 (£750/£950 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 23 May, 1955.

GENERAL ASSISTANT ENGINEER (CHEMIST) STAYTHORPE POWER STATION, NEAR NEWARK
Vacancy No. 74/55/ET

Candidates must have had a sound technical training and some previous laboratory experience, and should hold the Ordinary National Certificate in Chemistry (or equivalent qualifications).

Salary will be within Class J, Grade 16 (£515 x £15—£560 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 30 May, 1955.

GENERAL ASSISTANT ENGINEERS STAYTHORPE POWER STATION
Vacancy No. 75/55/ET

General Assistant Engineers are required at Staythorpe Power Station where suitable young engineers will be given opportunity to obtain operating and maintenance experience in the various sections of this large Generating Station operating at 900°/900 lb sq in. steam conditions.

Preference will be given to candidates who hold the Higher National Certificate, or who are at present pursuing a course of study with the object of obtaining this or a similar qualification.

Salary will be within Class J, Grade 16 (£515 x £15—£560 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 30 May, 1955.

These appointments will be pensionable within the terms and provisions of the Central Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form A.E.6/ACT which may be obtained from the Divisional Establishments Officer, Central Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated Please quote Vacancy number.

L. F. JEFFREY,
Divisional Controller.
(R 773)

CENTRAL ELECTRICITY AUTHORITY

North West, Merseyside & N. Wales Division

VACANCY No. E. 122/151/T.—ASSISTANT STATION CHEMIST, Carrington Generating Station. Salary £755/£800 (H.9), or £675/£720 (H.11).

Vacancy No. E. 122/154/T.—STATION SHIFT CONTROL ENGINEER, Wallasey Generating Station. Salary £555/£600 (D.10).

Vacancy No. E. 122/160/T.—ASSISTANT SHIFT CHARGE ENGINEER, Carrington Generating Station. Salary £755/£800 (H.9).

Apply to Divisional Secretary, Central Electricity Hse, 825 Wilmslow Rd, Manchester 20, before 21 May. Quote Vacancy No. (R 760)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments, which are superannuable and subject to medical examination:

1. SENIOR SERVICE CENTRE ASSISTANT in the Whitechapel Service Centre at Liverpool. Salary within the range £585/£645 per annum. (N.J.C. Grade 3.)

The selected candidate will be required to assist the Service Centre Supervisor in the control of the Service Centre, and applicants should have had previous sales experience on the commercial side of an electricity undertaking.

2. FOURTH ASSISTANT ENGINEER (BUILDINGS) required in the Construction Department, No. 1 Sub-Area, Liverpool. Salary within the range £715/£760 per annum. (N.J.B. L/13.)

Preference will be given to applicants who hold a Higher National Certificate in Building, and who have had experience as a Clerk of Works. The duties of the post will include the supervision of new buildings throughout the Sub-Area.

3. ENGINEERING DRAUGHTSMEN in the Board's No. 1 Sub-Area Headquarters. Salary within the range £510/£630 per annum. (N.J.B. Schedule D, Grade 6) according to qualifications.

Applicants should have experience in the layout of electrical switchgear and substations, and the possession of not less than Ordinary National Certificate would be an advantage.

Application forms for posts 1 to 3 obtainable from the Manager No. 1 Sub-Area, 24 Hatton Gdn, Liverpool 3. Closing date: 23 May, 1955.

4. DEMONSTRATOR (Female) in the Board's No. 4 Sub-Area, to be based on Wrexham. Salary within the range £425/£525 per annum. (N.J.C. Grade 1.)

Applicants should hold a diploma in Domestic Science or other approved certificate, and previous experience in the Electricity Supply Industry would be an advantage.

For post 4, standard application forms obtainable from the Manager, No. 4 Sub-Area, Electricity Hse, Rhostyllen, near Wrexham. Closing date: 23 May, 1955. (R 752)

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for the position of FOURTH ASSISTANT ENGINEER in the Technical Department at Board Headquarters, Glasgow (located at Broomhill Drive).

Applicants should have electrical engineering qualifications at least to Higher National Certificate standard, and should preferably have had some experience in the testing and commissioning of protective gear installations.

Salary will be in accordance with N.J.B. Schedule C, Class AX/DX, Grade 5 (£675/£860) or Grade 6 (£600/£785), depending on qualifications and experience.

Forms of application may be obtained from the applicant's appropriate officer, or the undersigned, and should be returned to the undersigned not later than Saturday, 28 May, 1955.

J MEEK,
Secretary.

P.O.Box 173,
351 Sauchiehall St,
Glasgow, C.2. (R 769)

ELECTRICITY AUTHORITY OF CYPRUS

ELECTRICAL ENGINEER

THE Electricity Authority of Cyprus require ELECTRICAL ENGINEERS for two tours each of 2 years with prospect of permanency. Commencing salary in scale £1,200 rising to £1,500 a year according to qualifications and experience. Free furnished quarters and passages. Liberal leave on full salary. Candidates, between 28 and 40, must have had sound training in both electrical and mechanical engineering with experience in the practical and administrative operation of electricity supply undertakings. They should possess competent knowledge of the operation and maintenance of 33 kV or

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ENGINEERS AND DRAUGHTSMEN

THERMODYNAMIC, NUCLEAR ENERGY, AND OTHER DEVELOPMENT

Merz and McLellan, Consulting Engineers, are recruiting high calibre men for their Development and Research and other Departments, where they are expanding their work on new developments, including advanced thermodynamic cycles for steam and gas turbines, and the use of nuclear energy for power production. Applications are invited from those with good technical qualifications including training in an appropriate field of engineering.

Vacancies are for junior engineers having these qualifications and also for engineers who have some years' experience on development or allied work in the same fields. Successful applicants would be given facilities, of which they would be expected to avail themselves, for learning the practice of the firm in power station design and construction.

The vacancies mentioned above arise both in the Newcastle and Surrey offices of the Firm.

In addition there are the following further vacancies in the Newcastle Office for which applicants should have sound mechanical or electrical engineering background. In the absence of the precise experience stated, applicants with equivalent experience might be considered.

(1) Mechanical Engineers for the Boiler, General Engineering, and the Test and Investigation Departments: good engineering degree and experience of design and operation of large boilers or of power station plant generally.

(2) Mechanical Inspecting Engineers with degree or H.N.C. and experience in production, manufacture and test of pressure vessels, turbo-alternators and ancillary equipment. Metallurgical, welding and non-destructive examination experience an advantage. Period of training will be given. Travelling to or residence in various parts of the country may be necessary.

(3) Senior and Junior Draughtsmen for General Engineering Department with O.N.C. of H.N.C. or O.N.D., and experience in power station layout and the design of all mechanical ancillary services.

(4) Electrical Engineers for Power Station, General Engineering and Rotating Plant Departments. Good engineering degree and some practical experience of design, construction or operation of electrical plant desirable.

(5) Inspecting Engineers for the Electrical Inspection Department with degree, H.N.C. or similar or alternatively with material inspection engineering experience. (Newcastle, Manchester and London Offices.)

(6) Senior and Junior Draughtsmen for Electrical Engineering Department with O.N.C. or H.N.C. and preferably experience in layout of electrical plant and substations although not essential.

Wide prospects of advancement with attractive initial salary according to qualifications and ability. Draughtsmen £650 at 25, and thereafter according to ability. Five-day week: pension scheme. Interesting work in congenial atmosphere.

Apply giving age, full details of qualifications and experience to:

MERZ AND McLELLAN, Carliol House, Newcastle upon Tyne 1, or MILBURN, Milbourne Lane, Esher, Surrey (R 767p)

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66 kV systems and the erection and maintenance of high and low voltage overhead and underground A.C. transmission systems, networks and substation plant. Preference will be given to Corporate Members of the Institution of Electrical Engineers. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2A/40498/EE. (R 731)

AN ELECTRICAL DESIGNER for Rotating Electrical Machines is required by South Wales Manufacturers. Applicants should possess a Degree, or H.N.C. or equivalent, and have had considerable experience in rotating machine design.

The appointment is a Senior one, and carries an attractive salary, with Non-Contributory Pension Scheme.

Applications to be addressed to Personnel Officer, Hopkinson Electric Company Ltd., Birchgrove, Cardiff. (R 644)

APPLICATIONS are invited for the position of TEMPORARY CLERK OF WORKS in the Transmission (Construction) Department.

Applicants should have had considerable experience in placing mass and reinforced concrete and general building work.

Salary will be £11 per week.

Applications in writing to Divisional Establishments Officer, Central Electricity Authority, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham. Please quote Vacancy No. 67/55/ET. (R 678)

ASSISTANT EXPORT MANAGER, aged 28/36, required by Electrical Control Gear Manufacturers, West London Area. Engineering Degree, Higher National Certificate or equivalent, and ability to handle technical and commercial correspondence are necessary qualifications. Good prospects. Commencing salary £850 per annum. Write —Box No. 4465, Electrical Times. (R 603)

AN electrical engineering DESIGNER DRAUGHTSMAN is required for a large and expanding factory in North Staffs. Minimum qualification O.N.C. (electrical) but H.N.C. preferred. The work calls for a high degree of initiative and includes Factory distribution and cabling; motor applications; control gear engineering; lighting schemes, substation work; power factor correction, etc. Assistance with housing given if necessary. Write in confidence stating age, qualifications, experience and present salary to the Personnel Manager, Michelin Tyre Co., Ltd., Stoke-on-Trent. (R 661)

AN experienced TRADE COUNTER ASSISTANT required by Electrical Wholesalers within 50 miles north of London. Salary from £10 per week.—Box No. 4511, Electrical Times. (R 741)

ASSISTANT wanted for electrical laboratory. Central London.—Box No. 4505, Electrical Times. (R 717)

BRUSH Electrical Engineering Co., Ltd., Loughborough, Leics, is seeking a CHARTERED ELECTRICAL ENGINEER for appointment to their agents in Rangoon. This is a senior appointment and applicants should be capable of advising customers at the highest level on the application of the Companies products, which include Switchgear, Transformers and Rotating A.C. and D.C. machines. Candidates should just have served a recognised apprenticeship with a reputable electrical engineering concern followed by experience of tendering procedure and handling of large contracts. Previous sales experience would be an advantage. Applications should be addressed to the Chief Personnel Officer. (R 744)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

ENGLISH ELECTRIC CO. LTD.
Stafford

have vacancies in their

INSTRUMENT DIVISION

for

SALES AND CONTRACTS ENGINEERS

preferably with H.N.C. or O.N.C. and some experience in this field.

Good prospects of future outside representation.

The positions offered are permanent, progressive and pensionable. Reply, in confidence, and quoting Ref. 1175G, to

Dept. C.P.S.
336/7 Strand, W.C.2

(R 590p)

BROKEN HILL, Northern Rhodesia. ENGINEER required with sound experience of installation, commissioning and maintenance of industrial instruments as used in the Chemical and Metallurgical Industries. A University degree or Membership of a recognised technical institution is desirable but not essential.

Basic salary £1,250/£1,750 per annum, according to qualifications, plus cost of living allowance and bonus at present £72 per annum, and 23½% of basic salary respectively.

Contributory Pension Scheme. Free life assurance, unfurnished housing and medical services.

Passages for successful applicant, with wife and dependant children, paid from present home to Northern Rhodesia.

Candidates should submit full particulars of career, age, marital status. Applications should be addressed to Anglo-American Corporation of South Africa Ltd., 11 Old Jewry, London, E.C.2. (R 733)

CABLE Factory requires Two (2) FOREMEN for opposite shifts alternatively, large growing Factory. Must have knowledge of P.V.C. Lapping, Braiding, etc., be conscientious, not afraid of hard work. Assistance will be afforded with accommodation and everything done to assist. Applications please state experience and approximate salary required.—Box No. 4479, Electrical Times. (R 647)

CENTRAL ELECTRICITY AUTHORITY Headquarters, Stations Sub-Branch, Bankside Hse, London, require a SENIOR ASSISTANT ENGINEER. The successful candidate will be responsible to the Supervising Engineer, Headquarters Stations, for co-ordinating construction work at those Stations. Duties will entail visits to sites and attendance at Site Progress Meetings. Practical experience in the construction of modern thermal power stations is essential. Candidates should preferably be Corporate Members of the I.MECH.E. or I.E.E. Salary N.J.B. Grade 1, £1,150/£1,500 per annum inclusive. Applications stating age, present position and salary and giving full details of qualifications and experience to D. Moffat, Director of Establishments, Winsley St, London, W.1, by 26 May, 1955. Quote Ref. AE/593. (R 745)

CONTRACTS ENGINEER required by Cable maker with Headquarters in London. Applicants should preferably have ordinary National Certificate and must have had good experience in the installation of all types of power cables. A knowledge of overhead line construction would be an advantage. Apply—Box No. 4513, Electrical Times. (R 742)

CHIEF TRANSFORMER TEST ENGINEER required to take full responsibility for Test and Inspection Dept. Salary commensurate with qualifications and experience. Apply in confidence to the Managing Director, Transformers (Watford) Limited, Sandown Road, Watford, Herts. (R 634)

DESIGNER DRAUGHTSMAN required for interesting development work on the design of small electro-mechanical mechanisms for use in switches, thermostats and similar devices. Salary up to £825 per annum according to experience and qualifications.

Contributory Pension Scheme, Canteen, Holiday arrangements honoured with pay.

Write, call or telephone for an appointment to Chief Draughtsman, "Diamond H" Switches Ltd., Gunnersbury Ave, W.4. Chiswick 6444. (R 739)

DRAUGHTSMAN - ENGINEER (Electrical) required, capable of laying out schemes, preparing specifications and supervising installations. Canteen and Social Club facilities. Apply stating age, experience and salary required, etc., to Personnel Manager, Tube Investments (Group Services) Ltd., Rocky Lane, Aston, Birmingham 6. (R 734)

ELECTRICAL SUPERINTENDENT. A vacancy occurs in the Birkenhead area for a fully experienced Electrical Superintendent to supervise manufacture of A.C. and D.C. rotating electrical machines up to 200 h.p./kW. Applicants should preferably have served a recognised apprenticeship and preference will be given to men having practical experience of armature winding. This position holds good prospects in a rapidly expanding Division and the work is of great variety and interest. Applications, in writing, should give age and full details of past experience.—Box No. 4507, Electrical Times. (R 718)

ELECTRICAL ENGINEER, graduate or H.N.C. essential, required for quality supervision of manufacture of paper insulated power cables up to the highest voltages. Previous experience of manufacturing processes desirable and must be exempt from national service. Age limit 25/35. Reply stating full details of technical background to: B.I.C. (Submarine Cables) Ltd., c/o the Secretary, W. T. Glover and Co., Ltd., Trafford Park, Manchester 17. (R 748)

ELECTRICAL ENGINEER required for Electrical Department of Works in the North East. He should have a sound practical training, drawing office experience, knowledge of motor control gear resistor calculations, and preferably some experience of electrical heating for industrial applications.

Apply giving full details of experience, technical qualifications, age, whether married or single, and salary required to—Box No. 4515, Electrical Times. (R 743)

ENGINEERING DRAUGHTSMAN Designer for London Office Workshop Trained; at least O.N.C standard. Required for the design and planned layout of special factory plant. Candidates should have experience in one or more of the following (*a*) Steam installations, (*b*) Electrical wiring. Pension scheme and canteen. Send age and particulars of training and experience in full to Box No. 8677, c/o Charles Barker and Sons Ltd., 31 Budge Row, London, E.C.4. (R 785)

ELECTRICAL ENGINEER required under contract by London firm of Consulting Engineers to supervise contractors on the installation of all electrical equipment required for extensions to an Iron and Steel Plant in India. Experience in installation of motors up to 500 h.p., switchgear transformers and cables up to 11 kV essential. Apply in the first instance with details of education and experience, to—Box No. 4491, Electrical Times. (R 675)

LEE, BEESLEY AND CO., LTD.

Electrical Installation Engineers invite applications for the position of:

SUPERVISING ELECTRICAL ENGINEER

Fully conversant with large-scale Electrical Contracting procedure and Estimating, to operate from Coventry Head Office.

Attractive and permanent position to suitable applicant.

Apply in first instance in own hand, giving full particulars of past experience, age and salary required to:

6 Warwick Row, Coventry.

(R 763p)

ELECTRICAL CONTRACTING MANAGER, preferably with Managerial experience, required to take charge of well established Branch Office in a large Northern provincial town. Must be competent and energetic Managerial Engineer capable of securing business and dealing with enquiries for Electrical Installation work on all types and magnitude. Remuneration: liberal basic salary plus commission on profits, also participation in Pension Scheme.

This is a fine opportunity with unlimited scope for a keen Managerial Engineer. Applicants are requested to write in the first instance giving essential details as to age, technical qualifications, experience and remuneration expected, which will be treated in the strictest confidence.—Box No. 4503, Electrical Times. (R 698)

ENGINEER with electrical or physicist degree required for development work on testing equipment for telecommunication cables. Permanent and pensionable position at salary commensurate with experience and qualifications. Please apply giving full particulars to Personnel Officer, Southern United Telephone Cables Ltd., Dagenham Dock, Essex. (R 669)

ELECTRICAL ENGINEERING DRAUGHTSMEN required by a firm of Engineers and Contractors on Tees-side for complete electrical installation, design, including motor application, control scheme engineering, distribution and cabling. Experience of contract work and estimating an advantage. Apply stating age, experience and salary required, quoting reference "W." to—Box No. 4443, Electrical Times. (R 548)

F.H.P. MOTOR TESTER required. Experienced in production testing of all types of small rotating machine, preferably with N.C. or equivalent standard. Write giving full details to Croydon Engineering Co., Ltd., Commerce Way, Croydon. (R 569)

INDOOR SALES ENGINEERS required by Crompton Parkinson Ltd., Chelmsford. Applicants must have initiative and be experienced in dealing with enquiries relating to A.C. and D.C. rotating electrical machinery up to 1,500 h.p./kW. Superannuation scheme and extensive social, sports and welfare facilities. Write, giving fullest particulars to the Personnel Officer. (R 660)

INSTRUMENT MECHANIC with electrical engineering background wanted for assembling, testing and adjusting precision-made automatic regulators in S.E.1 district and for overhauling on site. Preference given to holders of National Certificate. Write giving all relevant particulars to British Brown-Boveri Ltd., 75 Victoria St, London, S.W.1. (R 738)

LEE, BEESLEY AND CO., LTD.

Electrical Installation Engineers invite applications for the following:

ESTIMATOR
COST CLERK

For preparation and pricing of quantities for large industrial and commercial contracts.

JUNIOR DRAUGHTSMAN

preferably with electrical knowledge.

Excellent prospects for suitable applicants.

Applications stating age, experience and salary required, to:

Lee, Beesley and Co., Ltd.,
6 Warwick Row, Coventry.

(R 764p)

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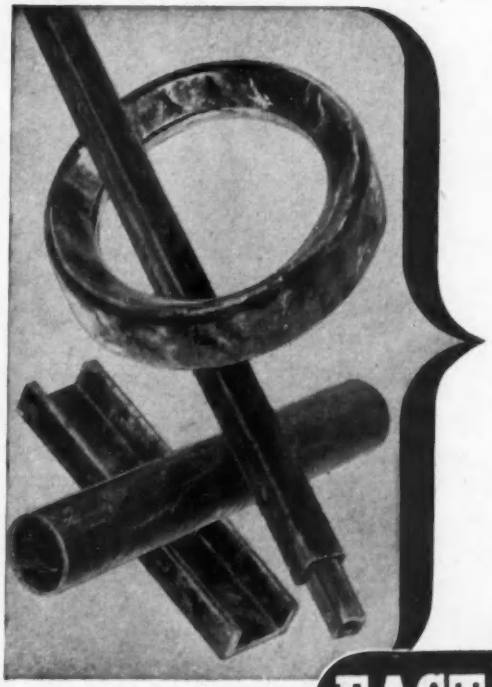

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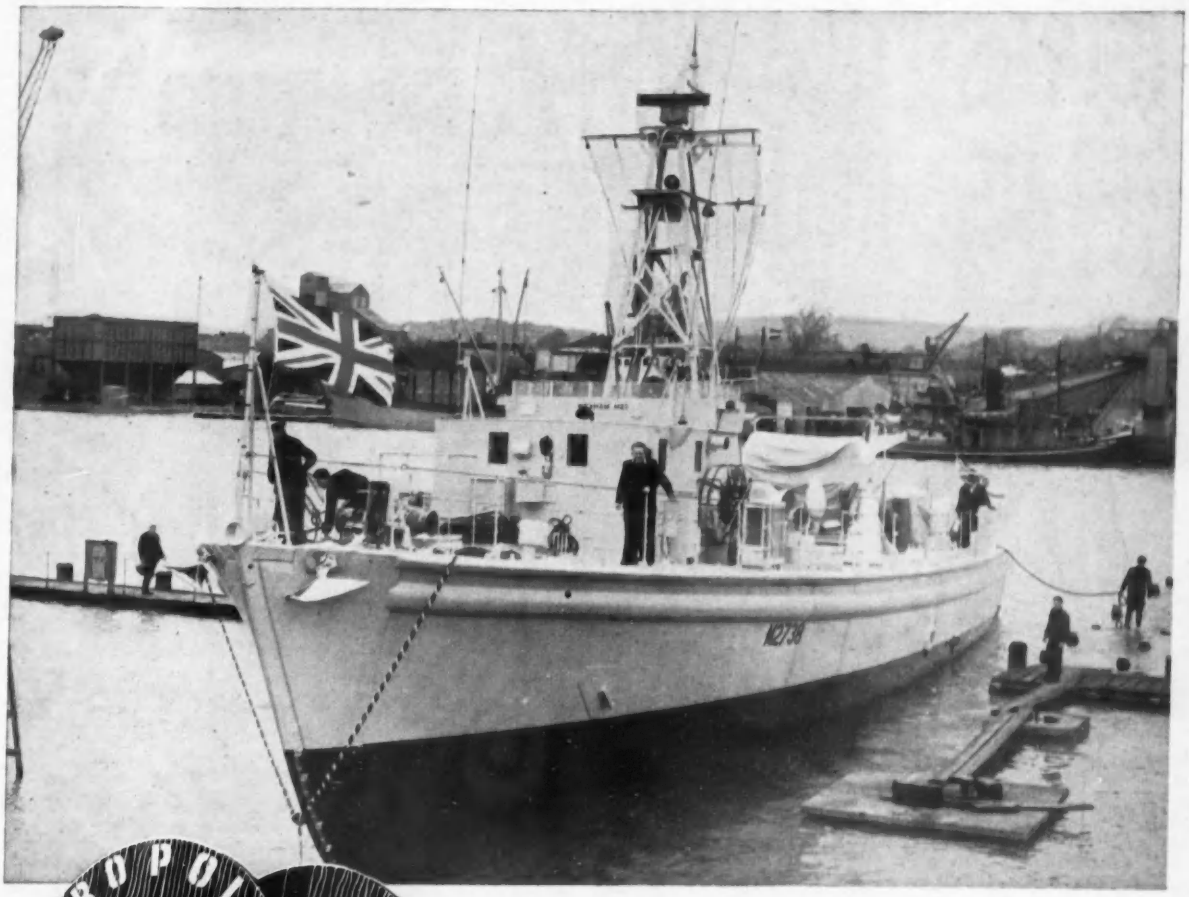

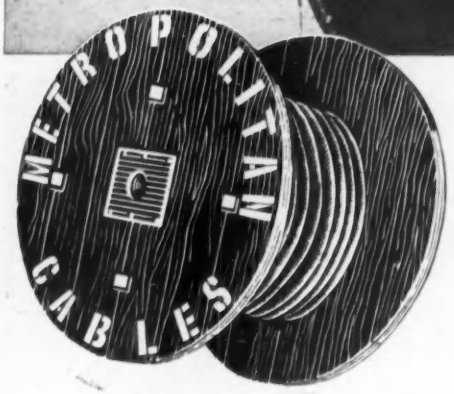

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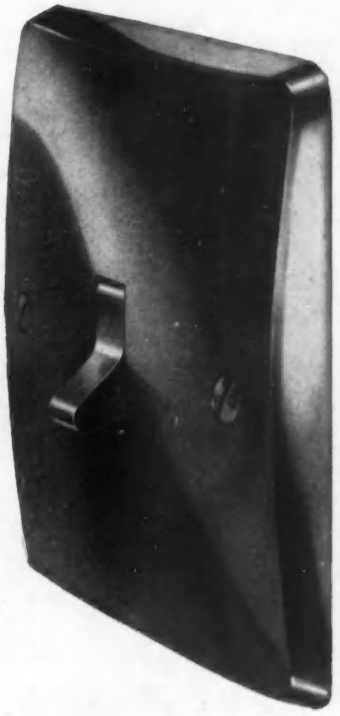

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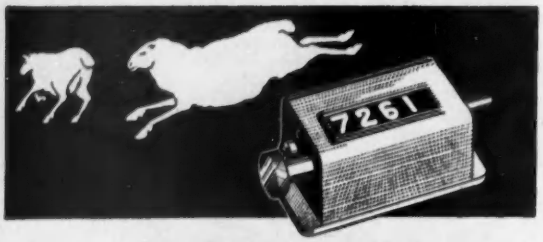

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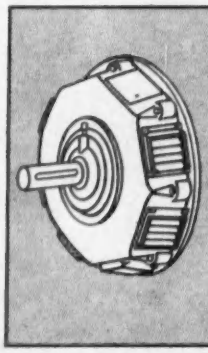	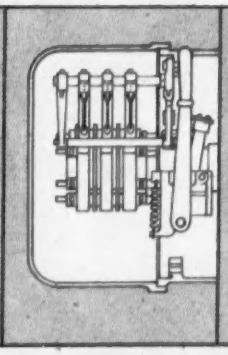	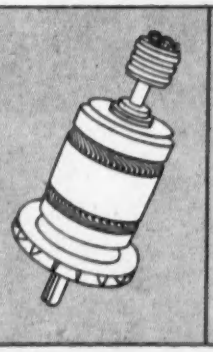	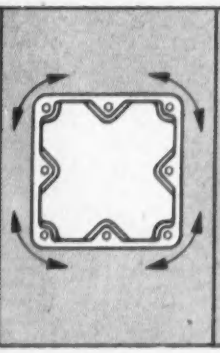	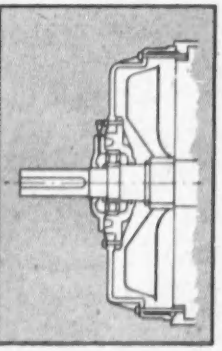
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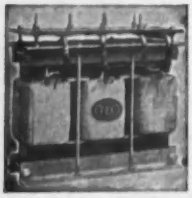

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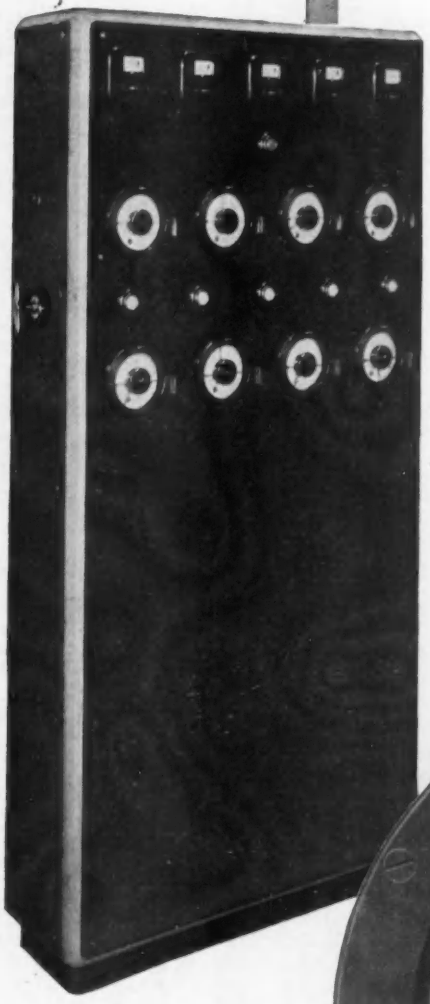

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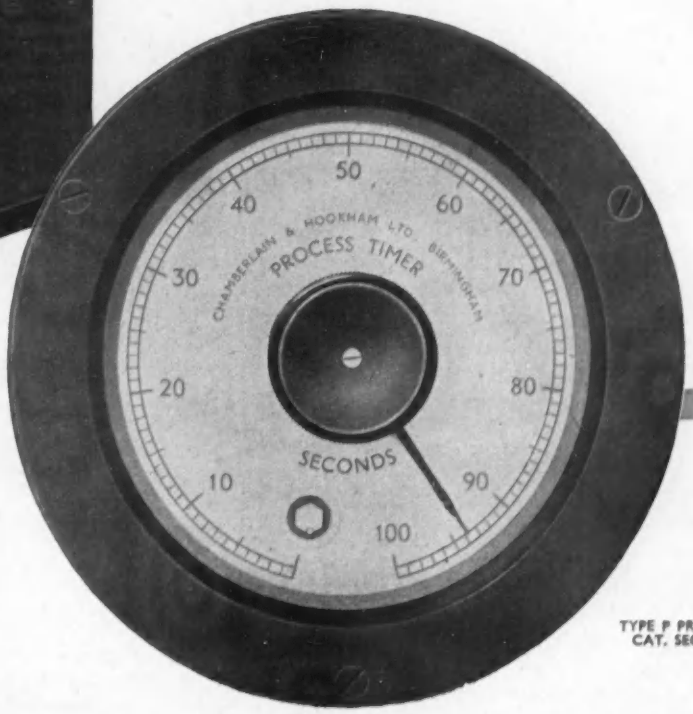

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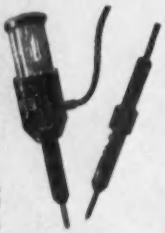

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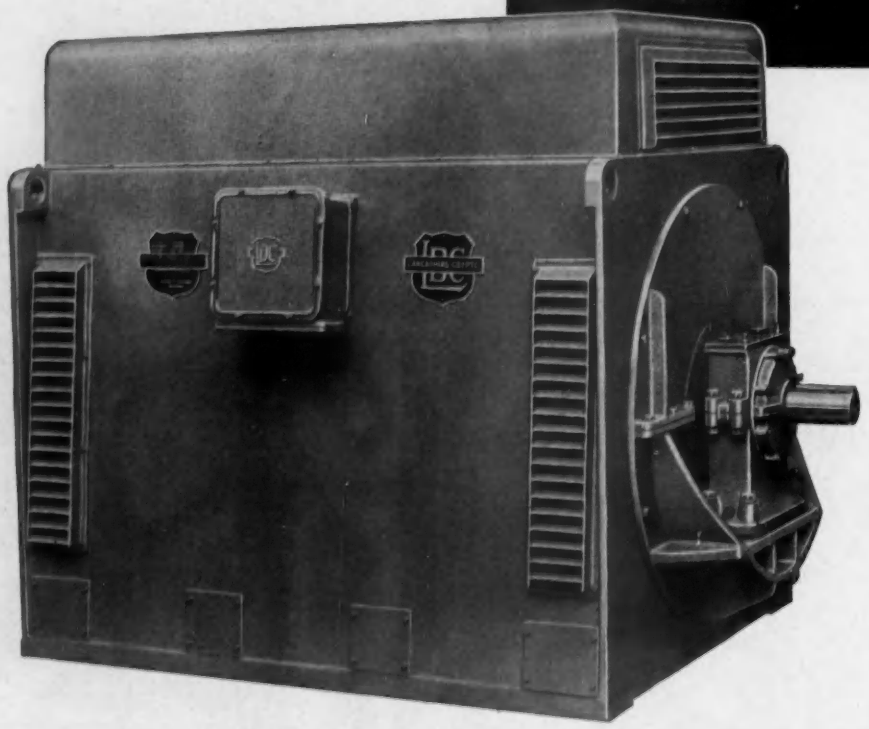

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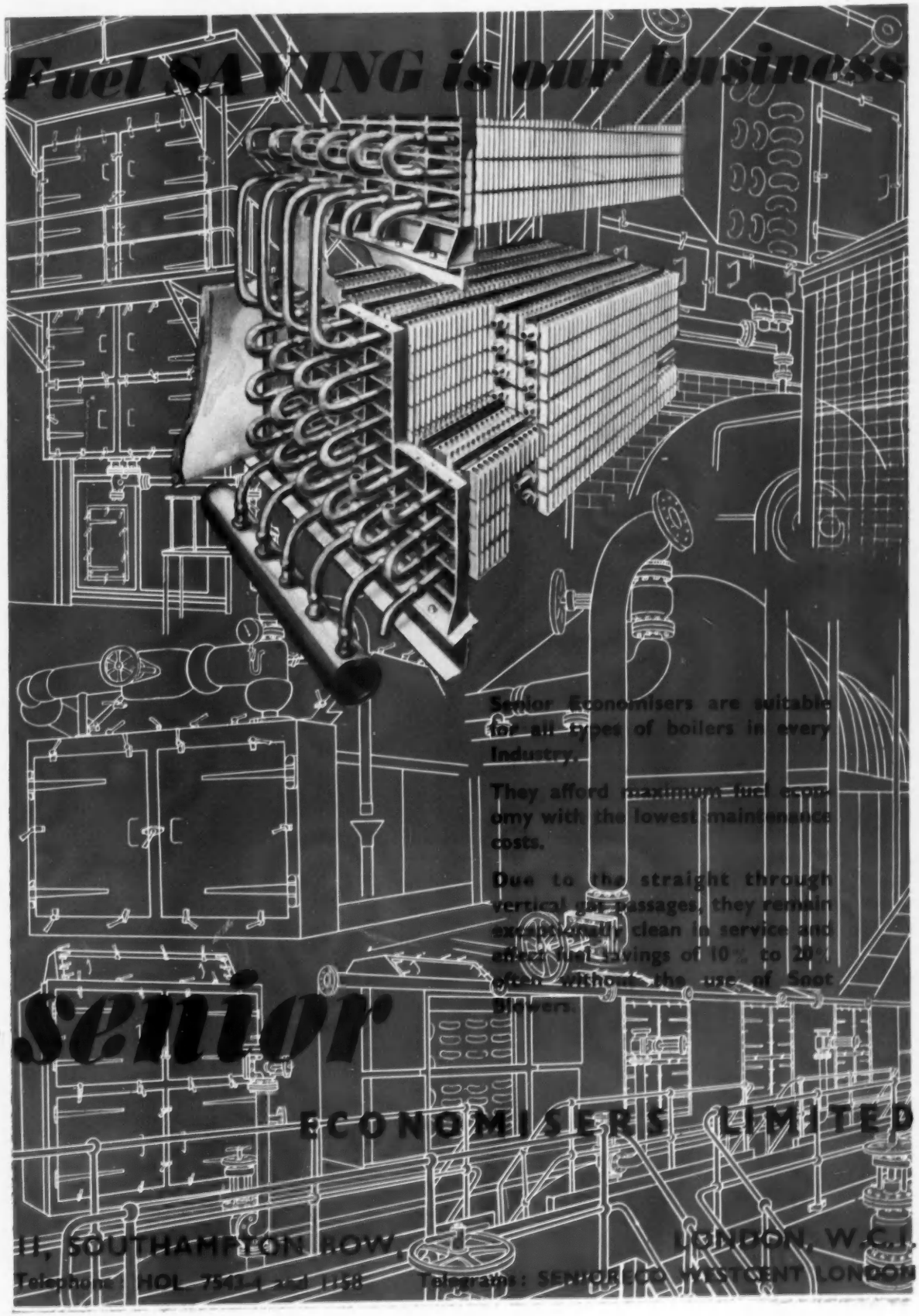
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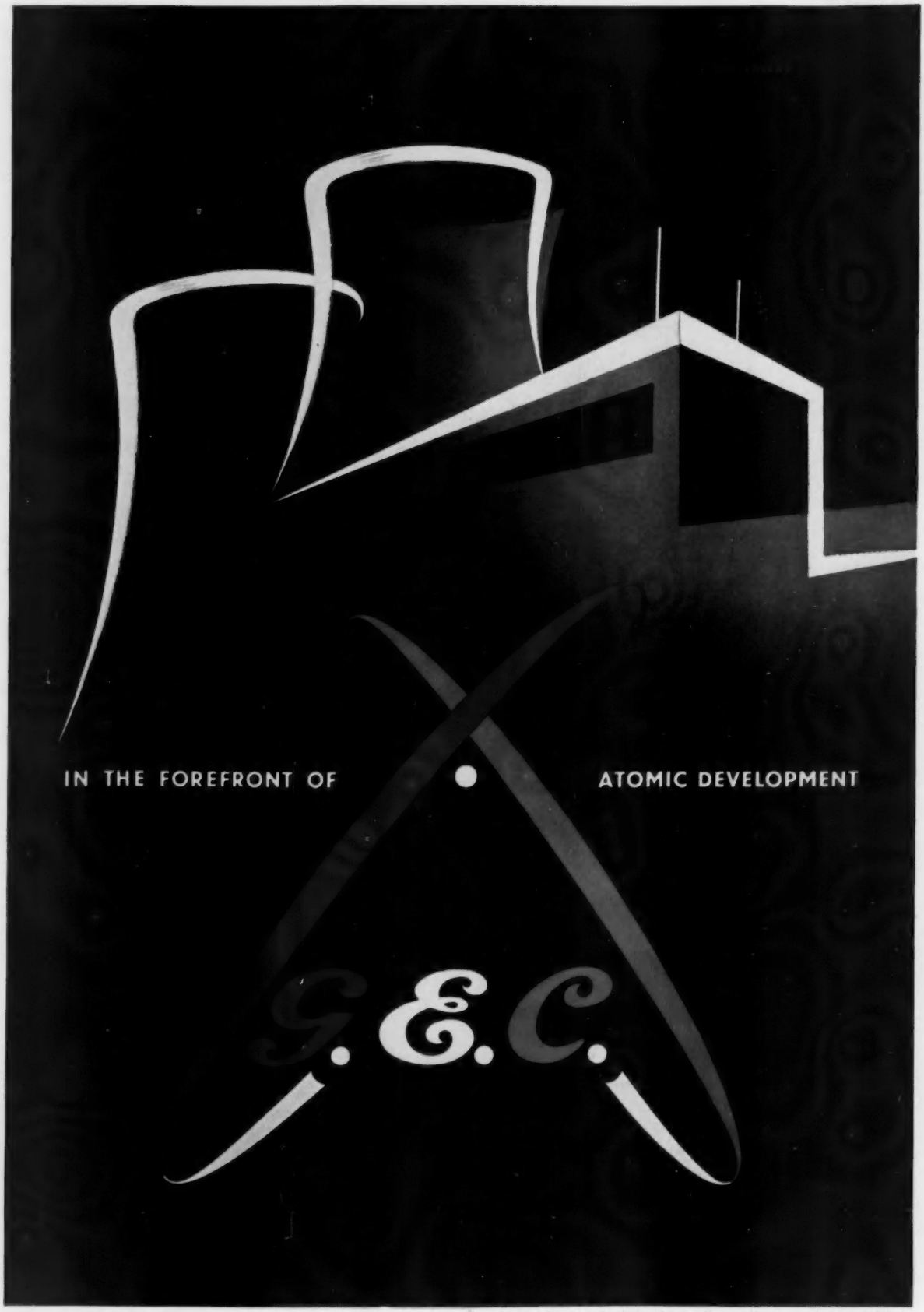

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